THE JOURNAL OF GAS LIGHTING
WATER SUPPLY & SANITARY IMPROVEMENT

VOL. LXXVI. No. 1951.] LONDON, OCTOBER 2, 1900. [52ND YEAR. PRICE 6d.

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FIRE-CLAY & BRICK WORKS,
STOURBRIDGE.

Manufacturers of GAS-RETORTS, GLASSHOUSE FURNACE & BLAST-FURNACE BRICKS, LUMPS, TILES, and every description of FIRE-BRICKS.
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HEBBURN MAIN GAS COALS.

Yield of Gas per Ton .	10,500 Cubic Feet.
Illuminating Power . . .	16·4 Candles.
Coke	68 per Cent.

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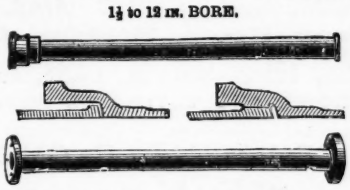
W. RICHARDSON, Fitter.

GAS AND WATER PIPES
1¼ to 12 IN. BORE.



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NAPHTHA AND GASOLINE DISTILLERS AND PETROLEUM IMPORTERS,
Specially distil Carburine Spirit, specific gravity ·680, or of any other grade suitable for Enriching Gas; also Gas Oil best adapted for injecting into the Retorts, as in the Herring Process.
Importers of Petroleum for Carburetting Water Gas, or for Manufacturing Oil Gas. Distillers of Pentane, Petroleum Ether, and Naphtha for clearing the pipes of Naphthaline, &c.
Samples and Prices may be had on application.

THE "MELDRUM" FURNACE
At "The SHEFFIELD TELEGRAPH" Offices.
Reprinted from "The SHEFFIELD TELEGRAPH" June 27, 1900.
A SAVING IN FUEL OF £18 PER WEEK.

A couple of months ago when coal, which formerly cost us 8s. per ton rose to 12s. 6d., we read a lecture on the cost of steam production by John Holliday, in which the following paragraph appeared:—

Mr. Bryan Donkin, M.Inst.C.E., has published figures from some tests he carried out with different kinds of fuel in the same boiler, the conditions in all cases being the same; the results are comparable on the basis of the cost of fuel required to evaporate 1000 gallons.

Kind of Fuel.	Cost of Fuel per Ton.	Water Evaporated per Pound of Fuel.	Cost of Fuel per 1000 Gallons Evaporated.
	s. d.	lbs.	s. d.
A. Dust Coke	5 0	6	3 8
B. ,, Welsh Coal . . .	10 0	8	5 3
C. Large ,, ...	22 0	9	10 11

Discovering that the Sheffield Gas Company made a considerable quantity of coke dust, which they gave away to builders and others, we entered into a contract for a supply for three years. Having a spare boiler, we had Meldrums' forced draught fitted, and soon discovered that coke dust made a very satisfactory fuel for steam raising. Our second boiler was then fitted, and we are now burning coke dust on the two almost exclusively. From an economical point of view, the experiment is very satisfactory, as will be seen from the following figures:—

Average week, Coal only, on One Boiler.

	£ s. d.
45 Tons at 12s. 6d.	28 2 6
Ashes at 2s., Seven Loads	14 0
	£28 16 6

Present Consumption on Two Boilers.

	£ s. d.
Six Tons of Coal at 9s. 3d.	2 15 6
Coke Dust	3 4 0
Two extra Stokers	2 12 0
Flues cleaning	10 0
Ashes, 12 Loads at 2s.	1 4 0
	£10 5 6

We shall be pleased to show the arrangement to anyone interested in the subject of the economical production of steam. There is no smoke from the chimney stack of the "Telegraph" Office, which is another good point in favour of coke dust as fuel.

Makers and Sole Proprietors: **MELDRUM BROTHERS, LTD.,**
Engineers, ATLANTIC WORKS, MANCHESTER.
LONDON OFFICES: 66, Victoria Street, Westminster. LEEDS OFFICES: 5, East Parade.
Telegrams: "MELDRUM" Manchester, London, or Leeds. National Telephone: Nos. 1674, Manchester; 193, Westminster; 1391, Leeds.

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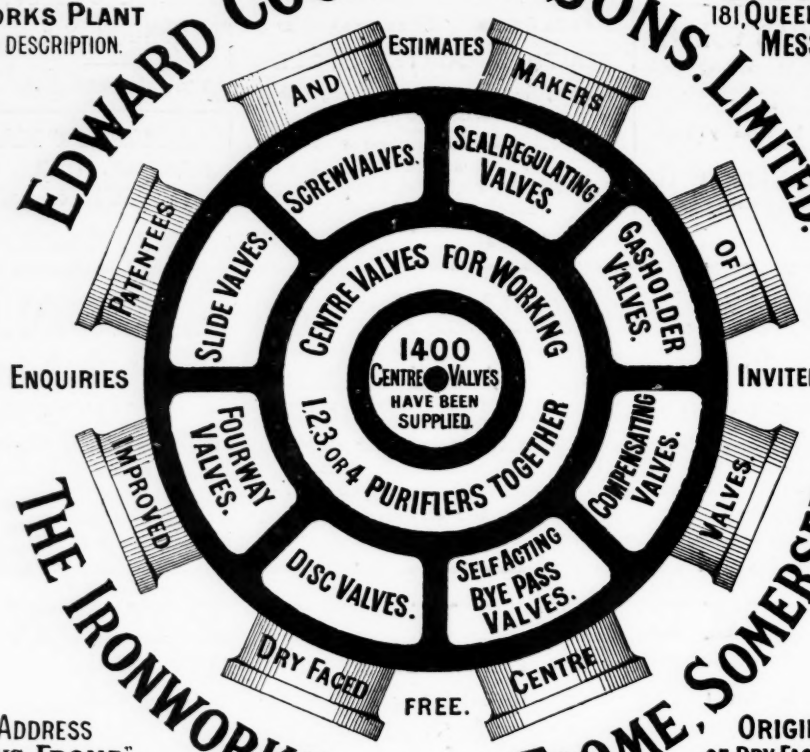

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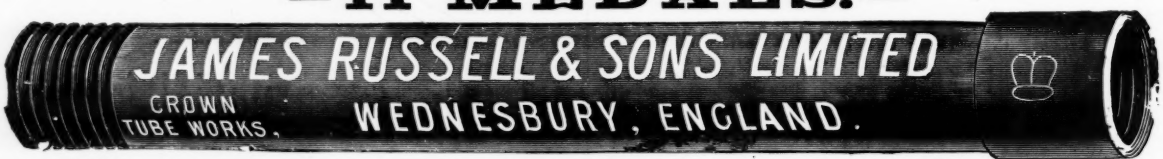

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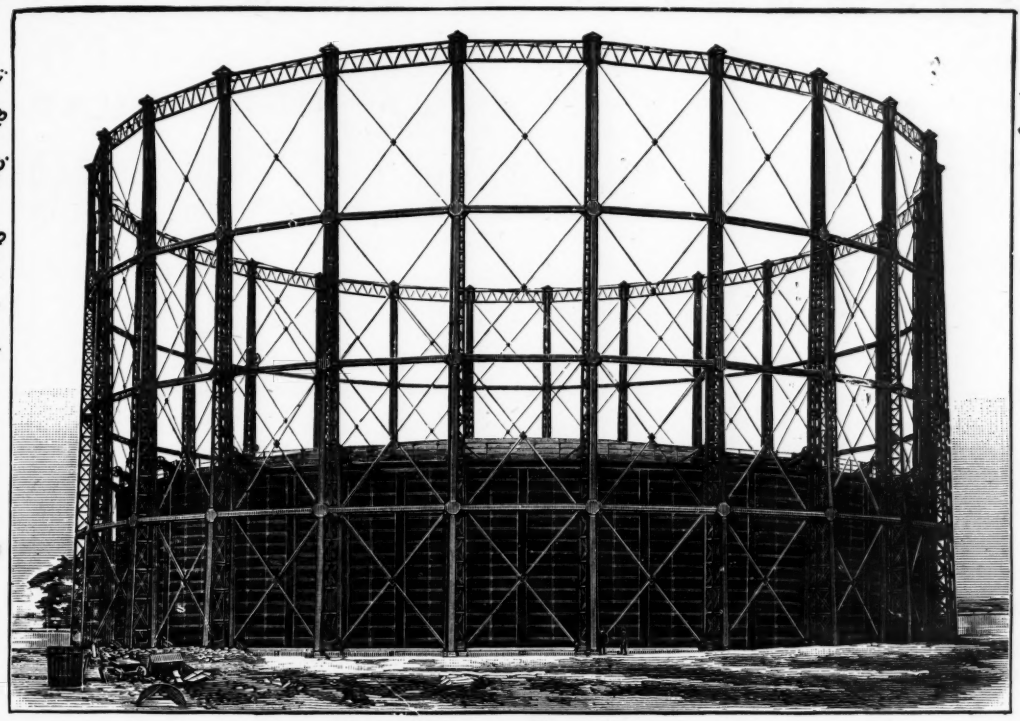

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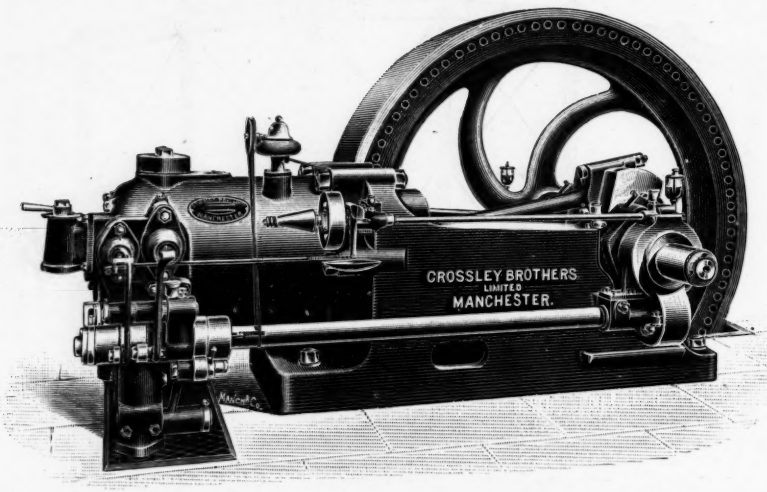

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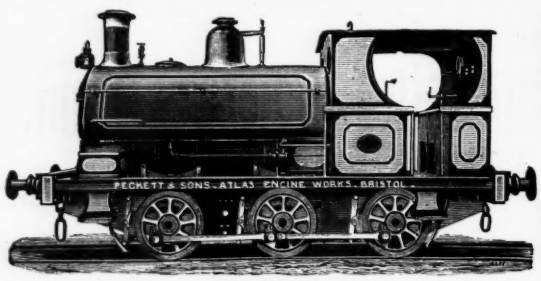

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THE PREMIER LIGHT OF THE PRESENT.

SLIT-UNIONS.

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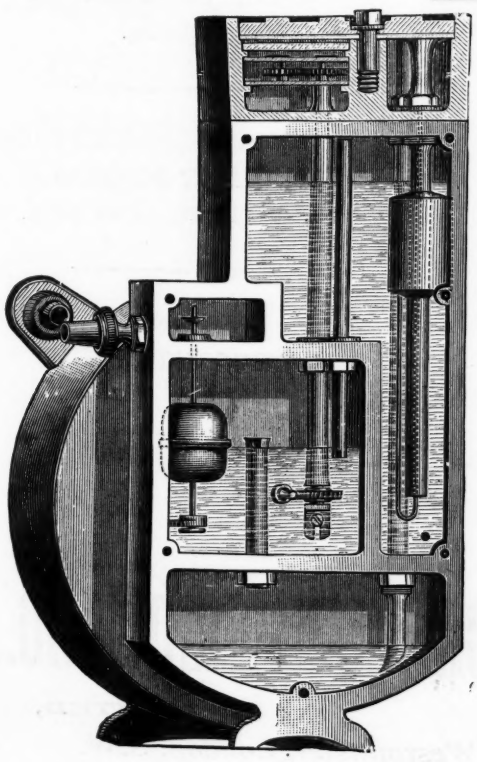

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BREAKAGE OF GLASS REDUCED TO A MINIMUM

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Perfect Diffusion.

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A Perfect Lantern for thoroughly Economical and Efficient Incandescent Gas Lighting.

VERY MODERATE PRICE HIGHEST POSSIBLE LIGHTING EFFECT.

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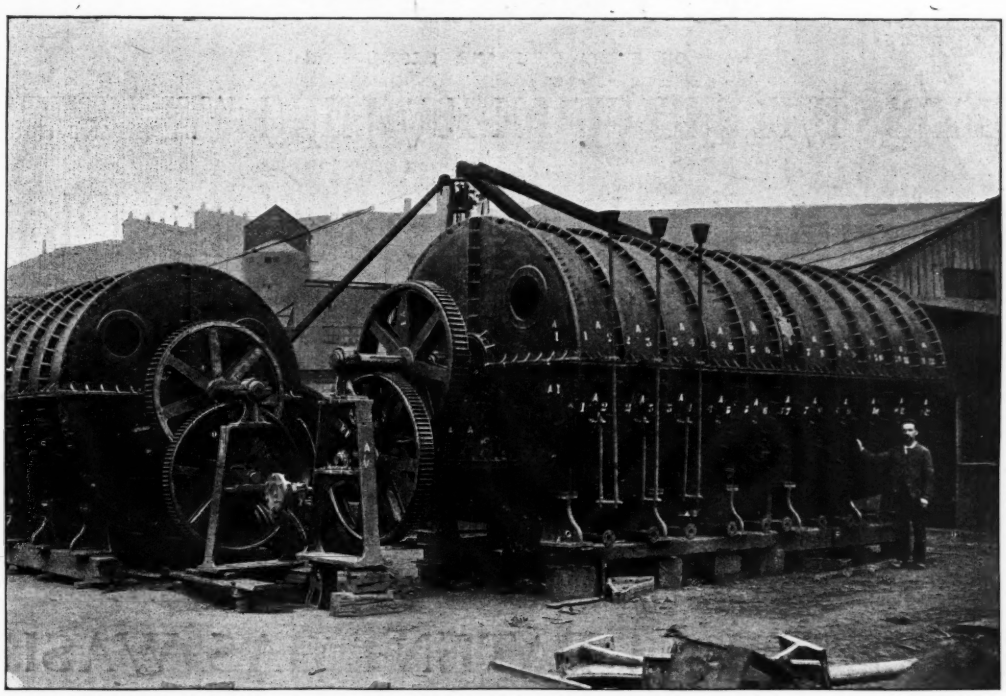
IN VERTICAL OR HORIZONTAL FORM.



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GLASGOW	1,250,000
Do. (Four Machines)	1,250,000
Do. (Four Machines)	2,000,000
Do. (Four Machines)	2,000,000
AMSTERDAM	2,000,000
BRYMBO	1,250,000
MORPETH	120,000
SHILDON	400,000
SUTTON-IN-ASHFIELD	200,000
CHATTERLEY	1,500,000
BROUGHTON-SOLVAY	1,250,000
Do. do.	1,000,000
KELSO	200,000
WISHAW	400,000
WIDNES (Two Machines)	1,000,000
Do. (Two Machines)	1,250,000
WOODSIDE (Two Machines)	400,000
Do. (Two Machines)	500,000
TODMORDEN	800,000
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Do. do. (Four Machines)	2,000,000
Do. do. (Four Machines)	2,500,000
Do. do. (Four Machines)	2,500,000
NORTH E. STEEL CO. (Four Machines)	1,000,000
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TROON	120,000
DUMBARTON (Vertical)	500,000
SALFORD	2,000,000
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STOKE-ON-TRENT	1,000,000
BRACKLEY COLLIERY (2nd Order)	1,000,000
Do. do. do.	1,250,000
CATERHAM	400,000
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Do. do. (Six Machines)	3,000,000
Do. do. (Six Machines)	3,000,000
Do. do. (Six Machines)	2,750,000
Do. do. (Six Machines)	2,750,000
Do. do. (Six Machines)	2,750,000
ROYAL ARSENAL (WOOLWICH)	2,000,000
ELLAND	1,000,000
NORMANTON	400,000
SUNDERLAND	2,000,000
BISHOP AUCKLAND	600,000
TYNEMOUTH	1,500,000
SELKIRK	500,000
BEVERLEY	500,000
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HASTINGS	2,000,000
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OF EVERY SIZE AND DESCRIPTION

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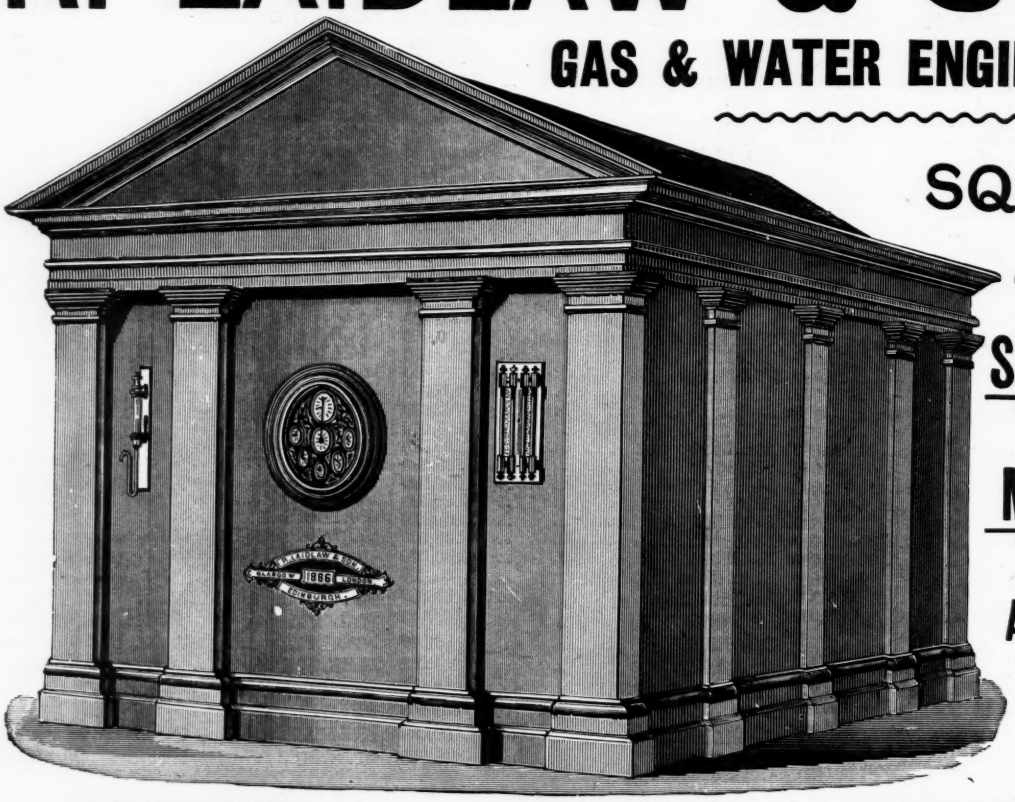

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DRY GAS-METER MANUFACTURERS.

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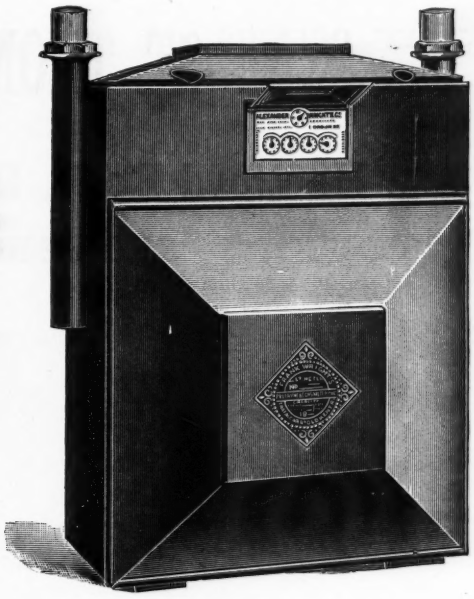

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FOR ENRICHING GAS IN BULK.

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THE ENRICHMENT IS INSTANTANEOUS AND PERMANENT.

The Carburettor is inexpensive, easily fixed, and entirely supersedes the use of Cannel.

SOLE AGENTS FOR REDWOOD & CLOWES' INFLAMMABLE VAPOUR & GAS DETECTORS.

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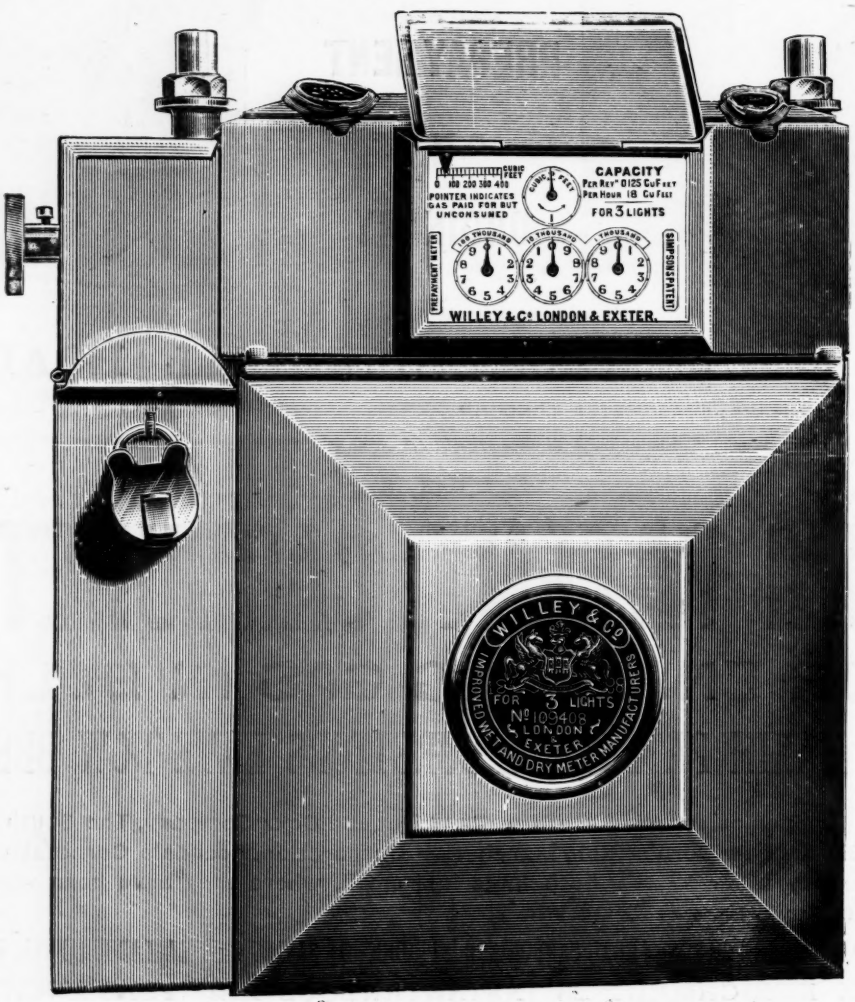

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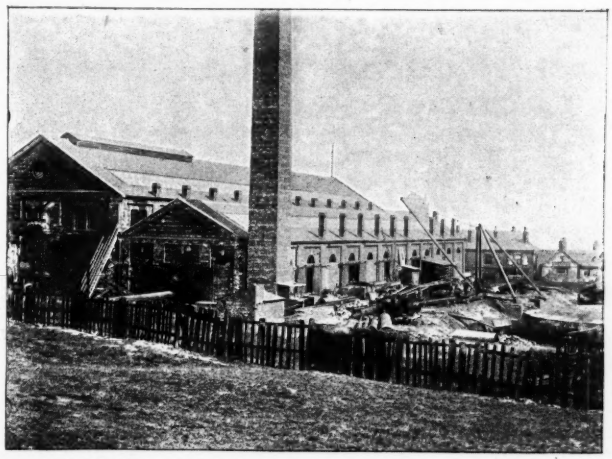

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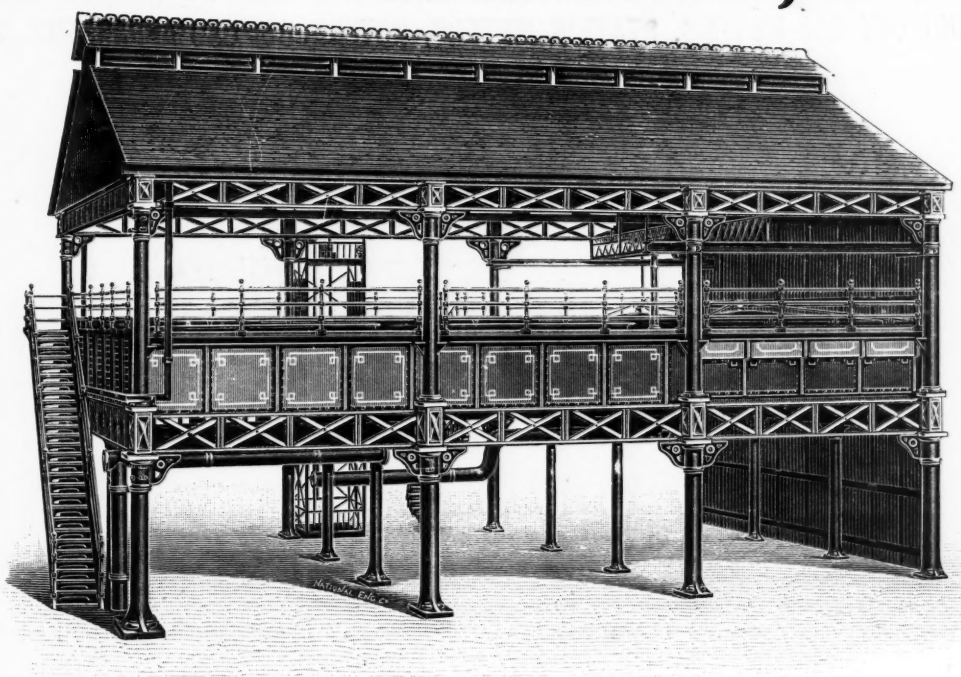

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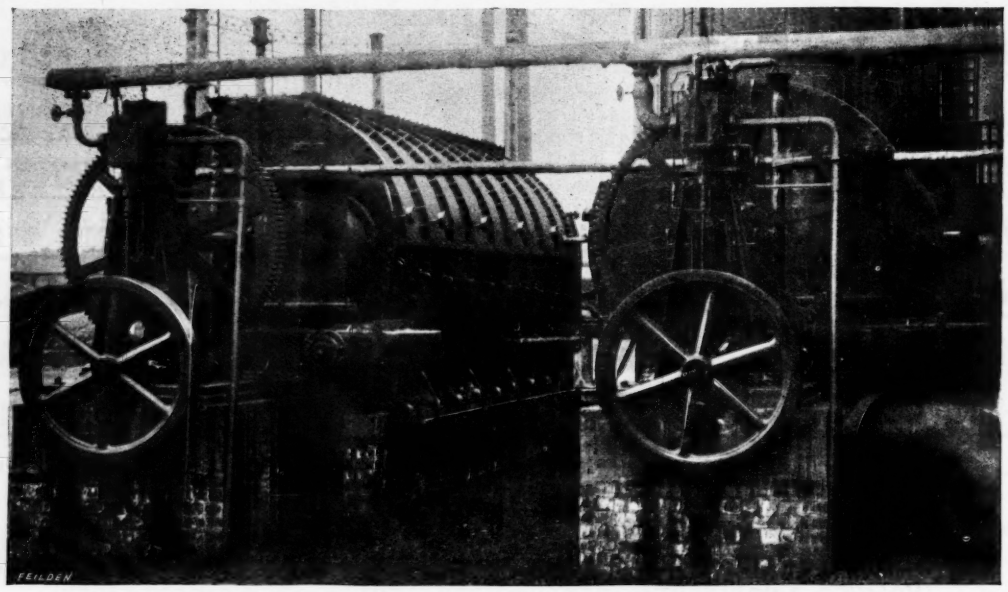

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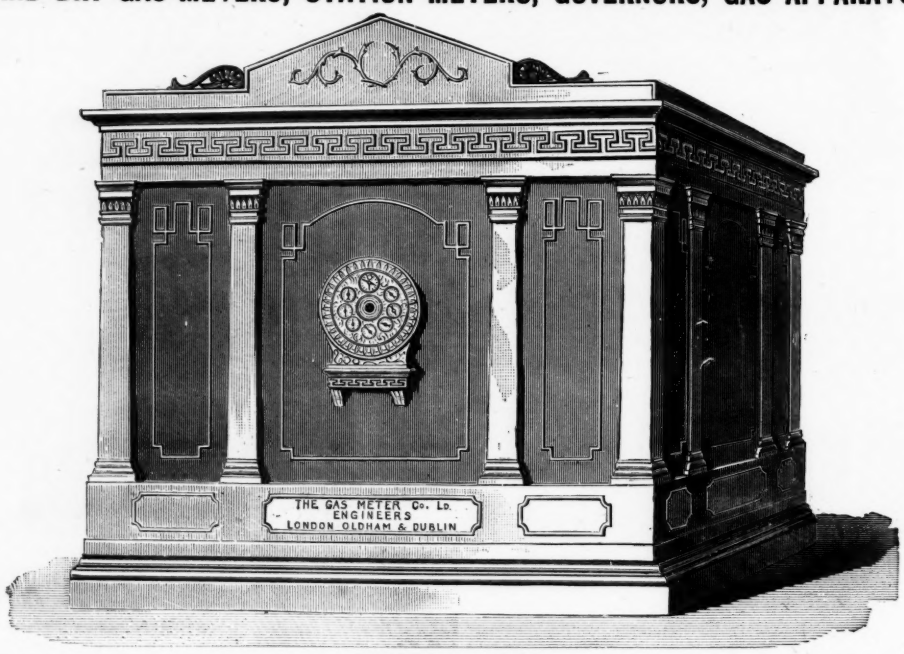

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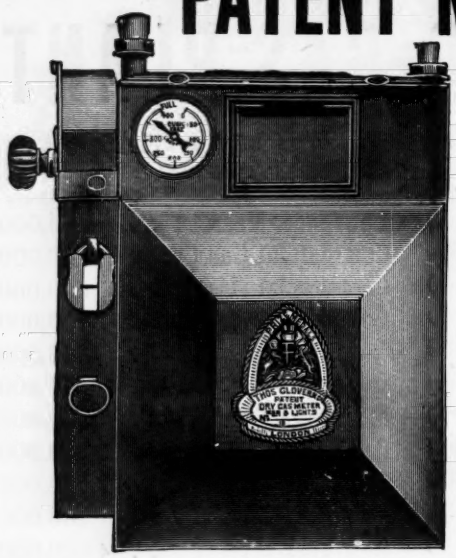

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NOTICE TO ADVERTISERS.

COPY FOR ADVERTISEMENTS for the "JOURNAL" should be received at the Office *not later* than TWELVE O'CLOCK NOON ON MONDAY, to ensure insertion in the following day's issue.

Orders for Alterations in, or Stoppages of, PERMANENT ADVERTISEMENTS should be received not later than the FIRST POST on SATURDAY.

EDITORIAL NOTES.

The Tottenham Gas Suffocation Case.

THE proceedings at the Coroner's inquest on the bodies of the victims of the sad gas poisoning case at Tottenham, which were reported in last week's "JOURNAL," possess a painful interest for all those who were immediately concerned in the affair, and a high degree of general interest for gas companies and consumers. The facts of the occurrence are clear enough. A new shilling-prepayment meter was fixed by the Tottenham and Edmonton Gas Company in the house of the Sanders family on Tuesday, Sept. 11. The Company's gas-fitter asked Mrs. Sanders to give him a shilling to start the meter with, which was refused him; and he therefore went away, after turning off the main-cock and warning the woman, if a leak should be discovered when the meter was put in action, to turn off the gas by the main-cock and give notice to the Company. The comment of the Coroner, "The man could not have done "more than he did," will be endorsed by the majority of reasonable people. It was given in evidence that, after the occurrence of the casualty to the two Sanders, father and son, on the following night, a shilling was discovered in the cash-box of the meter, and two burners were found turned on. Nobody owned to having put in the shilling; and the inference is that the elder Sanders must have done it after everybody else in the house had gone to bed. The wife's evidence further goes to show that the man was probably not in a condition at the time to notice whether the meter leaked or not. At any rate, she did not remember his coming to bed, or anything else until she woke up in the hospital. The verdict of "Accidental death" was the only possible one upon the evidence.

The most salient point of general interest in this mournful story is the proof that an escape of town's gas can prove fatal to sleeping human beings, while insufficient in quantity to make a mixture that will ignite at a naked flame in the same tightly-closed room. There does not appear to have been any means of ventilation whatever here. Blind chance arranges some striking experiments, sometimes. It can be easily understood that Dr. Haldane would have given much to have been the first to enter this house of Death, with his air-testing implements. It is not surprising that the Coroner's Jury wished to add a rider to their verdict; nor that the Company objected, and with success. In view of the possibility of civil proceedings against the Company, nothing ought to be said or done to prejudice the questions that may be raised.

We notice, however, that the "Lancet" has been moved to express some surprise at "the extraordinary method of "the Company," which it trusts is not "the universal rule," and remarks that "clearly it was the duty of the Com-"pany's official to have tested the meter and to have "ascertained that it was fixed properly." The common law of liability for the consequences of an act of proved negligence has frequently been laid down. Persons are bound to exercise ordinary and reasonable care and forethought in whatever they may do; but nothing more. The Gas Company in this case are responsible for the acts of their servant; but so is the consumer, with whom they do business, for the actions of his wife. It may be for the Court to determine whether there was legal negligence on the part of the Company, in not taking the meter away again when there was no coin forthcoming to completely test the soundness of the connections on both sides; or whether there was contributory negligence on the part of the consumer in not providing the wherewithal to make the test. It is obviously no part of a gas company's duty to supply consumers with coins to put into the cash-boxes of their meters. And the objection to allowing gas-fitters to have access to the cash-boxes under pretence of testing is equally obvious. There would be a loud outcry against a cast-iron rule that a prepayment meter must in no case be left in a poor man's house just because the wife did not happen for the moment to have the needful coin wherewith to start it.

The "Lancet," moreover, tackles us for having, in our "Editorial Notes" for the 18th ult., laid stress on the circumstance that the work of gas-fitting for the users of prepayment meters being done for them by the gas company, "is an effectual protection against any mishap "attributable to flimsiness of material, unsafe design, "or fraudulent workmanship on the part of some local "fitter." Upon this our medical contemporary remarks:

"We take it that the writer was referring to the ordinary "gas-meter; but surely the same 'effectual protection' "should be afforded (if such is the case) when slot-meters "are fixed. If not, the Company should be held respon- "sible for any accidents which arise through the defective "fitting of the meter which they supply." It has escaped the writer of these perfectly fair lines that we used the term "prepayment meters," which applies to what he calls "slot-meters," and also to other devices having the same object with which he is not familiar, not being in the business. Our words were carefully chosen, and do not refer to cases of pure accident, against which, of course, there can be no complete safeguard. We were merely claiming that a gas company's work is absolutely free from the shortcomings which are not unknown in that of the "jerry" gas-fitter. Lastly, gas companies already are fully responsible for any accidents that arise through their own defective work, whatever it may be; but the question of fact has, of course, to be settled in every case. It would be a great loss to the community if the prepayment meter branch of gas companies' business were to be so burdened with excessive financial risk that the companies found themselves driven out of it. There is a certain additional risk, of course, in this class of business, let it be never so carefully managed. Workmen will be careless sometimes, even in the best-regulated undertakings. All this gas companies are prepared for; but they do ask for simple justice, and protest against cases of "The Gas Company and the Public" being dealt with on the "rich company and poor consumer" principle. They have had ample experience of this Robin Hood's kind of equity in respect of other matters.

The Rumoured Rise in the Price of Coal.

It was rumoured in some of the daily papers last week that the price of coal was to be advanced at the beginning of this month, in view of the fact that, under the arrangement made recently between the owners and the miners, the latter would then be receiving an increase of 5 per cent. in their wages. The reports of the proceedings on the Coal Exchange yesterday are not to hand at the time of writing; but we hardly think it likely that the rumour will prove well founded. The suggested reason for an advance in price is, of course, altogether inadequate, as in the coal trade wages are directly governed by prices, and not *vice versâ*. If, wages having been increased because prices are high, prices were advanced because wages had gone up, it is difficult to see where the process would stop. The excuse put forward is, in fact, only an excuse; and the rumour was, we believe, circulated with the idea of creating a ground for a rise in price by scaring the public into the market to buy. The public, however, are getting used to the cry of "Wolf;" and those who have not already bought their winter's stock have concluded that they may as well wait a bit, because, as they say, things cannot be much worse, and they may be better.

That they will be better before long we do not doubt—provided that the Parisian meteorologists prove false prophets. They tell us the coming winter is to be abnormally severe; but perhaps they are only acting on the principle that if you keep on prophesying that which must ultimately come to pass, you will some day be correct, for they predicted precisely the same last year. True, the holly is already full of berry, which the country-folk maintain is a sure sign of a hard winter; but we have seen that forecast falsified before now, and believe the question of the weather for the next six months to be still an open one. At any rate, there is no possible justification now existing for putting up the price of coal; and it will be interesting to see whether the recent expressions of regret from coalowners, that such full advantage has been taken of the temporary scarcity, to the hurt of trade in general, were genuine, or were only crocodile's tears. The "Iron and Coal Trades Review" now joins the chorus of mourners over the sad necessity which has compelled iron and coal merchants, so greatly against their will, to charge the public such prices as have lately ruled. "The boom," says our contemporary, "has gone a little too far. It has "involved a certain amount of abuse of prosperity, which "may be attended with a corresponding Nemesis at a later "period." We presume the writer means that Nemesis will mete out a corresponding punishment to the abusers of prosperity. However, it is at any rate clear the prospect is not regarded with equanimity by the organ of the allied trades. It is true that "the men at the helm" are told that they "need not be much afraid;" but this sounds somewhat like whistling to keep up one's courage.

We do not, be it understood, prophesy a heavy fall in prices this side of Christmas—that would, we fear, be imagining a vain thing. But we do believe that the tide has turned, and that the worst is passed. The probability of an early settlement of the big strike in America is favourable to an easing of the situation; and the great efforts that are being made to increase the output in Germany, where the scarcity is most marked at present, will go to remove by degrees one of the obstacles in the way of cheaper coal here. Italy, too —one of our own large customers—is reported to be having recourse more freely to water-generated electric power in lieu of steam power, thereby reducing her coal requirements. Every mickle makes a muckle; and coal contracts next spring will be closed at figures very different from those at which the current agreements were negotiated.

Socialists in Congress.

To the meeting of congresses in Paris at the present time there appears to be no end. All industries and professions are having their foregatherings; and the air is filled with the reading of many papers, and the making of many speeches—some of practical value, others of no value at all. In the latter category may be placed the vapourings at the Congress of the Socialists, who had their innings last week. The Socialists have, it appears from the report of their debates, decided to form an International Committee "to meet occasionally in some Central European "town." What they are to do when they meet, we are not clearly told; but we can only say that if they accomplish nothing more practical and useful than passing resolutions similar to those adopted by the Paris Congress last week, the delegates had better reconsider the matter and save their travelling expenses.

The Congress first unanimously adopted a resolution in favour of eight hours as the maximum limit of the day's work in all trades. Well, of course, there was no harm in their doing this; but one had begun to hope that the obviously absurd proposal for an arbitrary limitation of the hours in *all* trades had already died of ridicule. The letter of a correspondent to the current number of the "Spectator," reporting a conversation with a Yorkshire farm hand, supplies just one, but that an all-sufficient, instance of the utter impracticability of the idea. "On a "farm," said the speaker, "even if you go to bed at eight "o'clock, you never know that you mayn't have to get up "to a cow calving, a horse ill, or something of that sort. "The Eight-Hour Bill would do no good to us; for you "can't have two men for every job, and, in farming, so "many things happen that you can't fix a man's time." Just so: "You can't have two men for every job;" and what would the mover of the aforesaid resolution say if the doctor left his bedside at a critical moment because his eight-hour day was up?

A corollary to this precious resolution was one in favour of a minimum or "living" wage. In the discussion that took place, the German delegates were guilty of a gross piece of impertinence. They talked common-sense; and where is common-sense more out of place than at a Socialists' Congress? The Germans "pointed out that it was "of no use fixing a rate of wages unless the price of the "necessities of life could likewise be regulated." It was really most inconsiderate of them to so neatly prick the bubble of that meaningless phrase "a living wage." However, nothing daunted—apparently regulating the price of the necessities of life was deemed to be a matter that could be arranged in a spare half-hour—the Congress passed resolutions declaring the need of having "strong "Trade Unions to fix and maintain the minimum wage," which should be sufficient to procure the means of a decent and healthy existence. Then a motion in favour of a universal First of May Demonstration was carried; but its passing led to the termination of that session of the Congress under somewhat amusing circumstances. So far, we read, the proceedings had been conducted with the greatest order; but a French delegate having proposed that the resolution should be printed, "Signor Costa re- "torted that the organizers of the Congress had dis- "appeared, together with whatever cash might be avail- "able for this purpose." A tumult ensued, and the Congress adjourned "after giving vent to expressions of "indignation at the cavalier treatment it had received." The practical step taken by the organizers to ensure the

redistribution of wealth was evidently not appreciated by the advocates of the process.

The only point worthy of serious consideration that is brought to notice by this assemblage of eccentrics and cranks is the growing tendency of the Socialists—observable especially in Germany—to leave their former attitude of "splendid isolation," in which they were practically powerless, and to ally themselves with the extremists in the other political parties. This tendency clearly makes for danger and trouble, more particularly in the labour world. It is fortunate indeed for England that the philosophy of Socialism has never widely commended itself to the mass of working men in this country, who, be their faults never so many, are too well balanced and practical in mind to ever be carried far by the wind of empty theory.

A Scandalous Story from Dundee.

An extraordinary story comes from Dundee, in the form of an article on "The Price of Gas" published by a local newspaper. It is reported that a very peculiar state of matters has been revealed in connection with increasing the charge for gas in Dundee, which was resolved upon at the annual meeting of the Gas Commissioners on June 20, when it was agreed to raise the price from 3s. 4d. to 3s. 10d. per 1000 cubic feet. Naturally, this increase was not regarded at the time with popular favour; but it passed. Now it appears that the gas bills just delivered throughout the burgh are made out at the higher price as from the previous rendering of accounts, somewhat vaguely stated as referring to "a certain date in March or April." This discovery is described as an unpleasant surprise for those householders who fondly believed that the price of gas stood at the old figure until it was increased on the date named. This is an old sore. The law as to payment for gas supply exists in several forms, and is very often summarized in the agreements with undertakers which prospective consumers are required to sign. These generally stipulate that the supply shall be paid for at the prices from time to time in force in the district for the particular class of consumption. There is no necessary time connection between the administrative act of fixing the price of gas and the executive acts of taking the register of the consumer's meter and sending in the account—except that they must affect accounts still to be rendered. There can be no such thing as making an increase in the price of gas retrospective, in the only proper sense of going behind the account previously rendered. Gas supply, however, is a thing in action, which goes on between certain regular periods for the making up and delivering of the accounts; and it would be a strong line to take that a statutory price may not legally be made and levied between any two meter takings. At the same time, one can sympathize with the view that a prudent gas administration would avoid giving occasion for raising any such question, by being beforehand with the notice of increase. A man likes to know the price of what he is about to purchase; and it is only fair to tell him. This grievance of the *pseudo*-retrospective operation of the Dundee increase is not the worst of the tale. It is asserted that the Commissioners "are actually granting "concessions to some, and leaving others to pay the full "amount." Some of the big consumers, so the story goes, have bestirred themselves in the matter, and have obtained special rebates. "In one instance, where the gas bill was "over £135, the rebate claimed was over £10; but the "representatives of the Gas Commission contented themselves with offering a rebate of £4 or £5, in order to get "the matter hushed up. According to these representatives, other parties have got a rebate to April 30; but "in cases where no complaint was made, no rebate has "been offered." Well may the newspaper remark that this is "a pretty kettle of fish." It is indeed, if the tale is true. Nothing like it has ever entered into the calculations of the partisans or even the opponents of the "principle" of municipal trading; and if the facts are as represented, the principle in question will have received a heavy blow and a great discouragement. But meanwhile we hold our belief in suspense. The whole narrative may be a scurrilous attack upon the Gas Commissioners and their Treasurer, Mr. Ritchie, whose alleged "unfair intentions" are supposed to be evidenced in this "exposure." An adequate official explanation of the whole affair is obviously called for, and it is to be hoped will be quickly supplied. The admirers of the theory of municipal trading may stand aghast at the insensate temerity of those who dare assail a perfectly disinterested corporation official with imputations of unfair dealing in his office, and a Board of Commissioners with "loose management" and "manœuvring." Alas! This is part of the cost of turning the town hall into a commercial emporium; and it is never wholly liquidated.

M. Violle on Photometry.

The trouble of reliable photometry is with the electricians, as it has long been with gas manufacturers. It speaks highly for the public spirit and disinterested devotion to science of our friends and rivals in the business of organized artificial lighting, that, though the photometer-room is not yet with them a possible stage on the road to the police court, they are sincerely solicitous for the improvement of the photometer. The subject has cropped up again through the presentation of a report on photometry by Professor J. Violle, to the Paris Exhibition Congress on Electricity. It is impossible to help sympathizing with Professor Violle's position in regard to his so-called International Platinum Standard of Light, which was acclaimed as a triumph of French science, and has rarely been seen since. Meanwhile, in high scientific circles the platinum standard is known as the imaginary datum for computing the value of the "decimal candle," which again has no corporeal existence, but is provisionally represented by the Hefner lamp, "subject to the necessary corrections." Why it would not be equally scientific to take the Hefner lamp for its own sake, instead of merely getting it accepted in this roundabout fashion, does not appear. It is interesting news that, by taking an infinity of precautions, M. Petavel has succeeded in reproducing the Violle standard, and considers that it is constant within about 1 per cent. It seems open to question whether it is worth while going through so much to gain so little; because the Hefner standard does not vary more than this. Standard flames, on the whole, are not loved by M. Violle, who, as a good Frenchman, prefers the old carcel lamp after all, if a standard of this nature must be used. A photometer fitted with Lummer and Brodhun's compound prism for bringing the illuminated surfaces together, and "Matthews's recording device, which enables the observer "to take his readings in the dark," is recommended by the "Electrician," after consideration of M. Violle's report.

The Lamp-Posts of London Town.

The great question of street lamp-post design is still labouring towards a solution by the tedious and costly process of trial and error. If anybody interested in the subject, being also the possessor of a snap-shot photographing machine, will take the trouble to walk across Waterloo Bridge (by common consent one of the finest monuments in London), we can promise him some sport. Starting from the last ordinary street-kerb lamp-post on the Surrey side, which is one of Mr. Livesey's new pattern columns with shadowless lantern for the incandescent gas-light, he can photograph, almost without moving from the spot, one of the ancient Georgian street lamp-posts, a 20 feet high arc lamp-post, one of the "birch-broom" design arc lamp-standards on the bridge parapet, and one of the original gas lamp-standards of the bridge. Nor does this variety exhaust the show. On the Middlesex shore there are half-a-dozen different patterns of lamp-posts in the hundred yards or so that separate the bridge head from the Strand, mostly (of course) hideous and very ill adapted to their purpose. Where could the pilgrim see the fellow to this exhibition? Echo answers, "Nowhere!" They manage these matters differently in Paris, in Berlin, in Vienna, and indeed wherever the streets are dealt with in an intelligent and dignified style. But anything is good enough for London—or so the Vestries and the London County Council appear to think. Will the new Municipalities do better by the streets? Doubtful. British public spirit is sadly lacking of artistic development.

Smoke Prevention Again.

It takes a very long time to educate our teachers. With the approach of the season for lighting up fires, the perennial subject of the "smoke nuisance" crops up again in popular periodicals and newspapers. This is quite right and proper; for the task of keeping the atmosphere of towns decently clean is too heavy for the authorities to perform without all possible support from the public. It is still with the cause of smoke prevention as it used to be with river pollution; all the pecuniary interest is on one side, and only the interest of the community on the other. Yet constant pressure and the power of instructed public

opinion proved effectual in the long run against the polluters; and so it will, and must, be with the owners of smoky chimneys, if the same degree of perseverance is exhibited. For a long time the work of river purification was hindered, rather than facilitated, by the prevalence of an illusion that the sewage of towns is possessed of some economic value. This seems a paradoxical statement; yet it is true. Empirical recipes for getting value out of sewage were tried during many years; and large sums of money were wasted in the endeavour. Meanwhile, many towns rested content to watch what others were doing, or amused the public with experiments of their own that were always tending towards a never-realized success. Manchester was like this. The Corporation had a "poudrette" factory which was a never-failing source of municipal entertainment; while it poured most of the sewage of the town into the available rivers, and eventually into the Ship Canal. After many years, a power even greater than the Manchester Corporation grew tired of this performance; and the Corporation have been fain to submit to the inevitable injunction to purify the effluent. Similarly, so long as the *dilettante* triflers with the problem of Smoke Abatement remained under the impression that what they called smoke consumption is a profitable thing to do, their very laudable cause hung in the wind. They relied on the force of persuasion and upon the imagined advocacy of the pocket; not knowing that the latter influence is all on the other side. Sir W. B. Richmond and his supporters of the present-day movement to the same end are better advised. They do not trouble themselves as to whether smokeless furnaces are or are not in point of fact more economical than smoky ones; they only know that all smoky chimneys are unlawful, and they put the law in motion against their owners. This being so, it is disconcerting to find the "Daily Graphic" last week, in a ladylike little editorial note on the subject, remarking that it is really very stupid of factory people to continue to emit smoke from their chimneys, because those who consume their own smoke have found it quite profitable to do so. It is a great pity that the professional leaders of public opinion in such matters do not pay more heed to the facts. It is not necessary to state for the hundredth time in these columns what the facts are; but the pity of it is that, while the general public are so ignorant of them, effective pressure will not be put upon offenders against the law. Besides, the suppression of smoke is as much a household as a factory-owner's question; and the same general solution—the employment of smokeless solid or gaseous fuel—is applicable to both branches of the problem.

Duration of the World's Coal Supply.—In his annual report (just published) on the Trade and Commerce of Germany, our Consul-General, Mr. Schwabach, calls attention to a further addition to the numerous estimates of the length of time that the coal resources of this country will last. This is contained in a publication which is the work of the celebrated Breslau geologist, Professor Dr. Frech, who also gives the result of his calculations as to the duration of the principal coalfields of Europe. According to those calculations, Germany, is the richest country in Europe in future stores of coal, and is only superseded in this respect by North America and North China. The following are Dr. Frech's estimates of the life of the various coal-beds. We are not told upon what principle the calculations are based; but it would, of course, be an entirely fallacious method to reckon the life of the richest fields at the number of years they could be depended upon to supply their present customers, as the tendency will naturally be for the whole world to draw its requirements from those mines as the poorer ones become exhausted. The question is, however, remote from present-day problems; and we quote Dr. Frech's figures chiefly to emphasize the fact that the exhaustion of our own coalfields (to say nothing of those as yet untouched in other lands) will not be witnessed by children of the youngest of us—

Duration (years).	Coalfields.
100 to 200 . . .	Durham, Northumberland, Central Bohemia, Kingdom and Province of Saxony (coal nearly exhausted), Central France.
200 ,, 250 . . .	All other British coalfields.
200 ,, 300 . . .	Waldenburg Schatzlarer district.
300 ,, 400 . . .	Northern France.
600 ,, 800 . . .	Saarbrücken, Belgium, Aix-la-Chapelle, and contiguous Westphalian districts, including the Ruhr.
1000 and upwards .	The greatest number of seams and the thickest are in Upper Silesia, Russian Poland, and Moravia.

Professor Frech concludes his paper with the remark that, "after a thousand years, when the European and North American coalfields are exhausted, it is possible that the coal and ironstone of Shansi may make this district a centre of the world's industry." Let us hope that the Far Eastern Question will have been settled by then!

ESSAYS, COMMENTARIES, AND REVIEWS.

GAS AND WATER COMPANIES IN THE STOCK MARKET.

(For Stock and Share List, see p. 826.)

THERE was no improvement in the state of things on the Stock Exchange last week, nor could any be expected, taking the circumstances into consideration. With the unpleasant aspect of affairs in China, with strikes and rumours of strikes in various parts, and with the throes of an election at home, it was impossible to extract a grain of comfort out of the general situation. Then there was the fortnightly settlement in progress, to check new business; and Jewish holidays helped to keep things quiet. The result was a dull week, with drooping prices. The fall in them was not considerable; but still they are down. The state of the Money Market also contributed to lower values; there being a strong demand for the end of the quarter, as well as for the Stock Exchange. Business in the Gas Market was fairly good for the time of year, and considering the general quietude. The tone was bright and cheerful; and several of the leading issues had a moderate advance in quotation, while *per contra* not one relapsed in the downward direction. In Gaslights, the ordinary was pretty brisk; and the closing day was the most active of the week. Prices steadily improved; the last marked being the best, and the quotation rose a point. The secured issues were moderately dealt in at good middle figures. South Metropolitan was much more active than it has been of late, and advanced a point, though the closing price seemed scarcely to justify it. Nothing at all was done in Commercials. The issue of their accounts to June 30 completes the record of the Metropolitan Companies to that date. They show that the Company have had a nice increase in their business, but that, like many other undertakings, they have not quite succeeded in earning their dividend in the teeth of ruling prices for coal. There was nothing of note to record among the Suburban and Provincial Companies. The Continental group, although very quiet, continued steadily on in the process of recovery; and both Union and Imperial advanced in quotation. Among the rest, Malta, Ottoman, and Cape Town had an advance. There was very little movement in Water; and only a few issues had a moderate improvement, while Southwark took a line of its own, as it does sometimes, and receded.

The daily operations were: The market opened steady on Monday, and, after moderate business, closed unchanged. The position on Tuesday and Wednesday was similar. On Thursday, Gas was quiet, and showed no variation; but in Water, Lambeth rose 2, and Southwark fell 1. On Friday, the volume of business was no greater; but several advances took place. Gaslight ordinary improved 1, Union and Imperial 2 each, and Malta ¼. Saturday was the busiest day of the week, and very firm. Imperial and South Metropolitan gained 1 each.

ELECTRIC LIGHTING MEMORANDA.

The Dynamo and the Dust-Cart: A Protest—The English Fashion of Electric Traction—Municipalism a Hindrance to Progress—The Mischievous Effect of Municipal Trading at a Profit.

RECENT remarks in this column upon the vanity of the idea of yoking the dust-cart to the dynamo, with the object of making the cost of central station electricity generation appear less in ratepayers' eyes, have drawn down upon us a small torrent of protestation from a firm who are interested in a different pattern of dust destructor from that in use at Bradford. We are asked, with much show of virtuous indignation, what we mean by laying so much stress on the experience of one man, who has never used but one type of destructor—and that one, of course, vastly inferior to a particular pattern of the apparatus which does wonders elsewhere. To all this tirade, we can only reply that our observations were based on a certain British Association paper, the conclusions of which were not contested. The point of this paper was the performance of a particular destructor plant at Bradford for a complete fortnight, which the author stated to be an unusually long test-period. General claims are as naught against these particulars of fact. It was not claimed in the paper that the plant in question was well adapted for steam raising—the contrary was, indeed, confessed. We have not the smallest objection to publish the results of the working, for the same period, of any other destructor plant in existence; and if they show that the combination of dust destruction and electricity generation for town lighting is good for anything else than the hoodwinking of ratepayers, we will confess the fact freely. Only, in fairness to Mr. M'Taggart and to ourselves, we cannot recognize the result of less than a fortnight's working; and if it could be the same fortnight, so much the better.

Many fluent persons habitually write about the comparative backwardness of electric traction facilities in the United Kingdom as compared with the United States, which circumstance (if they are English) they comfortably explain by referring to the stupidity and sluggishness of their countrymen. We all know the type, and few see anything admirable in it; because, as a rule, those who speak and write in this strain know nothing whatever about the subject. It is just as well to chronicle the fact that, notwithstanding our national conservatism, and all the rest of it, our Metropolitan system of underground electric rail-

ways is already far and away ahead of any service of the kind to be found elsewhere in the world. The success of the "twopenny tube" in London is indisputable; and it is not to be overlooked that English private enterprise has scored again, in this pioneer work, without invading the smallest of vested public or private interests. It sounds very fine to talk of the 18,000 miles of electric street railways in the United States; but notwithstanding the interested clamour of the electrical interests, the English people have had no use for that kind of electric transport. Neither has the British public seen the charm of overhead electric railways carried down the middle of business and residential streets. The useful dock railway in Liverpool is a special affair; and Londoners may well wish they had similar facilities for getting to and from their own docks. Apart from this exception, the right place for an electric railway is down out of the way of everything, while following the great natural lines of traffic on the surface; and that is where we have put them.

Strangely, and yet naturally enough, the progress of electric street railways, or tramways as we call them, throughout the United Kingdom generally has been retarded by the much-vaunted spirit of municipalism more than by any other influence. It is too much to expect recognition of the truth by our perfervid Progressives, who desire even a municipal milk supply; but practical statesmen, who regard facts more than talk, will be unable to take another view of the situation. It has been impossible for any electric traction company, whatever their resources, to cover the land with tramways on their system, after the American manner. Every independent local authority is supreme in its own district, be it large or small. And British local authorities, while they may be, and not infrequently are, deceived, can neither be bought over nor trodden underfoot in the rush of rival trading interests. Independence is at once the strength and the weakness of British local self-governing bodies. It is a commonplace how slow they are to learn of one another. They insist, very generally, in making their own experiments for themselves. Birmingham will not take pattern by Liverpool, nor Glasgow from Belfast. Years after a point of municipal engineering or sanitary practice has been satisfactorily established, or thoroughly discredited, as the case may be, in one or more parts of the United Kingdom, local authorities elsewhere will be found toying with it.

This has been very much the case with respect to the electric working of tramways. Private enterprise counts for nothing in this connection, because every English tramway is given over to municipalism from its cradle. Consequently, every corporation tramway department has looked at the matter exclusively from its own, sometimes small, standpoint. The result is, slow progress and chaos. Central municipalities have been unable, even where they might be willing, to survey the local tramway situation in its entirety. Municipal Manchester or Birmingham, for example, are not the same as Tramway Manchester or Birmingham. The creation of independent local authorities in the vicinity of large centres of industry and of population has been a very good thing in its way; but as regards the proper development of an adequate tramway service capable of being worked at the rate of 12 miles an hour, it has come to be very much in the way. The horse tramcar jogging along the mainroad is a different element from the electric car flying over the route with a speed and frequency that puts the usual suburban railway train to shame. Bristol is favourably situated in this regard, having no independent and possibly hostile outlying authorities to reckon with. And the tramway profits do not go to relieve the city rates. There's the rub! Perhaps, when the Lord Mayor or the Town Clerk of Manchester or Birmingham gives the world the benefit of his ripe judgment on the consequential effects of the introduction of electric tramway working, he will consider the influence of this common source of the dislike and distrust of central municipalities by outlying populations.

American Gaslight Association.—The number of the "American Gaslight Journal" just to hand contains the general announcement by the Secretary of the Association (Mr. Alfred E. Forstall) in regard to the forthcoming annual meeting, which will be held at Denver (Col.) from the 17th to the 23rd inst., under the presidency of Mr. George G. Ramsdell, of Philadelphia. The business will be transacted at the Brown Palace Hotel, which will be the head-quarters of the Association. The following is the list of papers: "The Use of Cards for Records and Accounts," by Mr. W. C. Anderson, of Norristown (Pa.); "Inclined Retorts," by Mr. A. H. Barret, of Louisville (Ky.); "Gas Advertising," by Mr. C. R. Collins, of Seattle (Wash.); "The Uses of Gas for Manufacturing Purposes," by Mr. J. H. Walker, of Milwaukee (Wis.); "Municipal Control of the Price of Gas," by Mr. Alfred E. Forstall, of Montclair (N.J.). There will also be a lecture by Dr. E. G. Love, of New York, on "The Theory of the Incandescent Gaslight." If the papers are of a sufficiently high standard, the Beal Medal will be awarded to the author of the one considered to be the best. In addition to the papers and lecture, the report of the Research Committee will deal with the question of the Edgerton standard, referred to them at the last meeting, as well as with other subjects. According to present arrangements, the entertainment portion of the programme includes an informal reception at the Brown Palace Hotel on the evening of the 18th inst., and a trip to Colorado Springs and vicinity the two following days.

PROFIT-SHARING IN PRACTICE.

We have in former articles* dealt somewhat fully with those sections of Dr. N. P. Gilman's book, entitled "A Dividend to Labour," which treat of schemes adopted by employers for the advancement of the welfare of the working classes by means other than that of profit-sharing. It is now our purpose to review the section set apart for the consideration of the results of profit-sharing as exemplified by the experience of five large firms—one French, one English, and three American—who have given the system a fairly extended trial. In the advocacy of this system, Dr. Gilman has taken no small part; his book on the subject, published in 1889, having served to enlighten many employers as to what had been, and what might be, done by means of profit-sharing to improve the relations between those, on the one hand, who provide the capital and the organizing and administrative ability necessary to the successful working of an industrial undertaking, and those, on the other, who provide the equally necessary labour. Dr. Gilman now chiefly concerns himself with the experience of the ten years subsequent to the publication of the work to which we have just referred.

The first of the five firms whose schemes are dealt with is the well-known Paris house of Baille-Lemaire, the opera-glass manufacturers. The general policy pursued by them, of paying great attention to the training and welfare of their employees, is most admirable; but the profit-sharing arrangements made by them, while doubtless found to be well suited to the particular firm in question, are not such as would perhaps lend themselves to adoption by employers generally, and so need not be discussed at length. The effect of these arrangements, so far as the employees are concerned, is that the workmen take 25 per cent. of the profits; two-thirds of the amount going, in unequal shares, to the staff and the foremen, and one-third to the rank and file, according to wages and seniority. After this year, the proportion of profits taken by the employees will be increased to two-fifths. Features of the arrangements made to promote harmony between the firm and the workers are the three social gatherings—a summer outing at M. Baille's country house, a banquet and ball in the winter, and a New Year's Day festival.

The Bourne Cotton Mills of Fall River (Mass.) provides "a striking illustration of what profit-sharing can do . . . in a line of industry in which the rate of compensation to the worker is not high, comparatively, in which the first cost of the plant is large, the importance of hand labour by the side of machinery is low, and in which the average grade of intelligence is not up to the common level of the environing society." The latter point is of special interest and importance; as, of course, the essence of success in regard to profit-sharing is that the workers should appreciate its obligations, as well as its advantages. The Bourne mills were in this respect handicapped by the fact that many of their hands were "comparatively unintelligent" French Canadians. Yet, in spite of this initial drawback, and of the fact that of the ten years during which the profit-sharing scheme has been in vogue four have been years of extreme depression, the experiment, though subjected to continuous hostile criticism by the other mill-owners in the city, has really been most successful. The Directors, through their Treasurer, have taken every care to ensure that the men should rightly understand the system, and to emphasize the duty of every man contributing his share to the prosperity of the undertaking. This, as in every case where profit-sharing has been adopted, has been the chief difficulty—a difficulty which can only be removed by the exercise of much patient tact, combined with firmness. The better to bring home to each man his individual obligation, all employees in the Bourne mills desirous of participating in the profit-sharing are now required to sign the following contract:—

> Please enter my name in the profit-sharing roll for the term ending . . . ., upon the conditions named and hereby agreed upon—namely, that I will endeavour throughout the term—
>
> (1) To do faithful service as an employee of the corporation;
>
> (2) To promote its interests as far as my acts and influence go, both in and out of the mill (knowing that its success will contribute to my own welfare, too); and
>
> (3) To deposit some sum of money every month, if possible, in the Employees' Savings Fund, or in some savings-bank;
>
> It being further agreed that I shall forfeit all claim to any share of the profits if any of these conditions be infringed.

Every employee who has served six months, and who works faithfully during the year, has a share in the profits "in proportion to the dividends declared and paid to the stockholders." Their "divvy," as the men call it, varies according to the amount of their wages. The average for ten years has been 3·3 per cent. on the wages they have earned. Moreover, the average wages were 10 per cent. higher in 1897 than in 1889, though in the earlier year the standard rate was higher than in 1897, and the mills ran two hours more per week. "The tendency has been uniformly to increase;" while employment has been almost constant throughout—a matter of supreme importance to the workers. Not only, however, have the earnings of the employees risen steadily, but the dividends paid have been nearly double those earned by the competing mills of the district. No wonder that "the Superintendent and the Treasurer unite in declaring that it has been a pleasure rather than a task to do business under these conditions," which, be it noted, are declared to be in large measure due to profit-sharing.

* *Ante*, pp. 406, 691, 756.

Another American firm—the Procter and Gamble Company—who, as soap makers, employ but little skilled labour and pay comparatively low rates of wages, have found profit-sharing to prove eventually successful. They had, however, uphill work at first. Having suffered much from strikes, due to all sorts of trivial causes, the Company adopted profit-sharing in 1887, "in order to secure relief and establish friendly relations with their employees. The plan gave a reasonable salary ($4000) to each active member of the firm, as a portion of the expenses. The net profits were divided between the firm and the employees, in the proportion that the wages bore to the whole cost of production." The scheme at first was viewed with suspicion, and only accepted in a half-hearted way by the hands; and, finding that even three half-yearly dividends averaging over 10 per cent. on wages failed to materially increase the interest taken by the employees in the successful working of the business, the Company took a step somewhat similar to that which the South Metropolitan Gas Company had to adopt for a like reason. They divided their hands into four classes: "Those who tried to prevent waste and do better work, and to advance the interests of the business, were to be paid twice the regular dividend. The bulk of the employees were to receive the regular dividend. Those who did not show much interest were cut down to one-half; and the careless, indifferent, and wasteful were to receive no bonus whatever."

This step has been so successful that indifference has entirely disappeared. Fully 92 per cent. of the whole number employed now participate in the bonus—which has been amended to equal the same percentage on wages as the shareholders receive on their stock—and the Directors have found themselves able to abolish the classification, merely reserving their general right to refuse the bonus for any special cause. Any waste or loss of material due to carelessness or neglect by an employee, is charged against his bonus; but, owing to the much greater care taken, not 1 per cent. render themselves liable to any deduction. Every employee is encouraged to become a stockholder, though no obligation to do so is imposed. About 15 per cent. of the whole number of hands hold stock; and, "in order to induce the employees to become stockholders more generally, the Company . . . is intending to guarantee them against loss by making their stock a first lien upon the property. 'A most marked improvement,' says one of the firm, 'is shown by those who have purchased stock, not only in their ability as employees of the Company, but in the general character of the men.'"

The Company have had no serious labour troubles since 1887—the year in which profit-sharing was inaugurated—and declare that they no longer have any such difficulties to fear. "On several occasions some troublesome fellow has tried to produce dissatisfaction. The men themselves have gone to the foreman, with details of the attempt, and the suggestion that the disturber be discharged." One great advantage that has accrued is the permanency of the staff. "The expense of breaking-in new men has been almost done away with;" not more than 2 per cent. of the hands being changed in a twelvemonth. Moreover, a great deal has been accomplished in the direction of labour-saving; some of the improvements in the machinery being due to the interest taken by the workmen. The saving in material used is also considerable. Altogether, "the patience of the Company, in educating their employees up to appreciation of the plan, has had its just reward."

The third American profit-sharing enterprise described is that of the Nelson Manufacturing Company, of Leclaire (Ill.), makers of plumbers' goods, bicycles, &c. The most noteworthy feature of their scheme is that since 1890 the bonus has been paid entirely in stock. The success of the introduction of profit-sharing in creating the best relations between the Company and their employees, was proved in the adverse times of 1893, when not only was no bonus paid, but wages were reduced 25 per cent. The unusual course was adopted of making a similar reduction in salaries and in interest on capital; the whole deduction from wages, salaries, and interest being made good out of subsequent profits, before any bonus was paid. The hands, "seeing the obvious fairness and the plain necessity of this arrangement, ratified it cordially."

The one instance given of an English firm adopting profit-sharing is that of the South Metropolitan Gas Company, with the details and history of whose scheme our readers are so familiar that we need not enlarge thereon. Dr. Gilman makes one or two slips in his account of the Company and their scheme. For example, he speaks of their annual receipts as being about £700,000, which is less than half the actual figure. Again, although he gives the standard dividend correctly at the revised figure of 4 per cent., he says that "for every reduction of one penny in the price of gas, the Company may increase its dividend one quarter of one per cent.," which was, of course, the increase allowed under the old sliding-scale applying to the Company. Apart from these unimportant mistakes, Dr. Gilman gives a very able account of the work accomplished by Mr. Livesey; especially calling attention to the unique feature of his profit-sharing scheme, the representation of the men on the Board of Directors.

In a further chapter, entitled "Profit-Sharing To-Day," is given a brief summary of the position of the movement at the present time in the principal countries; while in an appendix will be found a full list of all the firms who have adopted some plans of granting a "dividend to labour." Dr. Gilman has worked hard in the cause, has produced a most interesting and valuable book, and deserves the gratitude of all true well-wishers of the working classes. His prime virtue is that he tells, not only of the ideal, but, most fully, of the practicable; and, *pace* the poet, it is better in things mundane to be the man who "goes on adding one to one, his hundreds soon hit," than he who, "aiming at a million, misses an unit." If only social reformers would leave aiming at millions, and add one practical unit to another, the world would be the better for it. Dr. Gilman points to some of the units.

A SKETCH OF THE HISTORY OF THE GAS SUPPLY OF NEW YORK.

[First Article.]

The political and financial history of the gas undertakings of the United States has always been a mystery, not only for English observers from a distance, but also for many Americans connected with the gas industry. English students of gas supply systems have failed to penetrate through the surface of the American gas business, and therefore have never understood the jargon of "franchises," "combines," "deals," and such-like terms which obscure the native literature of the subject. They know that a real or professed belief in the validity of competition in the gas supply of towns has survived in American public opinion, long after the abandonment of the idea in other lands, and regardless apparently of painful experience in this respect of almost every town in the United States. It is also known abroad that there is in the United States no such national, or even State, legislative regulation of the gas industry as exists in England; while the Continental concession system is equally unknown in America. The prevailing impression in the minds of foreign observers of the great American industry is, therefore, that in this land of liberty the gas companies carry on their business as they please. This impression is occasionally deepened by news of the sudden outbreak—say, in New York City, or Chicago—of a desperate "Gas-Rate War," whereby two or more rival companies endeavour to cut one another's throats; only after awhile to make friends again at the expense of the helpless consumers. It is further strengthened by what is common knowledge of the irresponsible way in which the character of American towns' gas is occasionally changed altogether at the bidding of external "interests," as when the carburetted water-gas manufacture was forced into vogue irrespective of industrial considerations. On the other hand, the existence of real legislative power over the gas companies of the United States is manifested now and again by the passing of State laws fixing the selling price of gas in a particular town, apparently on arbitrary presumptions.

It is not within our power to fully set out the base-conditions on which the gas industry of the United States is founded, though we can perhaps indicate the nature of some of them. While this industry is not bound in the same fetters in which the collective wisdom of other nations has, with the best intentions, seen fit to tie it up, it is far from being the "wild-cat" business which casual outbreaks would really seem to indicate. American gas finance is based, in the first and last place, upon the national belief that there should be no artificial limitation of the legitimate profits of industry and commerce. Hence American and British gas finance separates irreconcilably at the point where the latter comes under the rule of limited dividends. This rule is directly opposed to American business principles. American business men cannot see why a gas company, like any other commercial concern, should not pay 50 per cent. dividends, if it can earn them legitimately. They argue that the prospect of making this practically unlimited profit is the best incentive to good working that a gas company, in common with any other business firm, can have; and they remain strong in this opinion, notwithstanding the results of the operation of other principles exemplified in London, Paris, and the civilized world generally.

Americans point out that, although theoretically the profits of private commerce and industry are limitless, in practice they are very fairly kept within reasonable bounds by the play of natural forces. The same with one of their gas companies. Nobody cares what rate of dividend the original adventurers of capital take, so long as the service is good and the price reasonable. Where this is not the case, instead of there being local gas agitations and parliamentary contests, another party of adventurers applies for a gas "franchise"—which is only a bigger name for the formal permission to open the public roads and lay mains, familiar enough to the promoters of non-statutory gas undertakings in the United Kingdom—and either gets it and opens a competing business, or the prospect brings the old firm to its senses. This is, of course, the theory of the thing; and Americans contend that, on the whole, it has worked, and continues to work, better with them than the British system of lulling gas companies to sleep under the protection of their Acts of Parliament. An Act of Parliament, it is observed, is only needed by British gas companies for their protection from the possible withdrawal by the local highway authority of the permission to use the public streets for their mains. The price paid for this protection is, in American judgment, excessive. They point to the actual state of gas affairs in London, as proving that the whole British system of statutory interference with the commercial liberty of undertakers of gas supply is a failure. If it is replied to this judgment that the

test of satisfying the public with the quality and price of the service is hardly good enough for the purpose, they have the ready rejoinder that this is precisely the real and only standard accepted by gas-supplying English municipalities to-day. The trading municipalities fix this standard for themselves; and they pocket all the profit they can make under these conditions of their own choosing. The trail of the Act of Parliament is over them still. The consumers have no voice in the matter at all. In the American system, the public themselves set the standard of efficiency. There is no real call for the municipalization of gas undertakings in America.

There is not, in the United States Constitution, any superior authority over "franchises" to the local governing body, whatever it may be. Hence there can be nothing equivalent to a British Act of Parliament for the protection of a gas company in the enjoyment of dividends, limited or otherwise. The position of an American gas company, having a franchise, is, therefore, akin to that of the holder of a public-house licence in this country. Of course, this position is one of real advantage, notwithstanding the fact that it reposes on the pleasure of the grantors. The condition of the "licensed trade" in the United Kingdom offers ample evidence to prove that what is sometimes invidiously called a "monopoly" can be created without a Private Act of Parliament. The obvious fact of the matter is, of course, that, under favourable conditions, any special trading privilege becomes a valuable asset of the grantee; and people have a way of setting store by property of any kind.

This has been the source of the gas troubles of the United States, just as it has caused the question of the licensed drink trade to arise in this country. Where a gas franchise was patently valuable, there was the temptation to make "deals" in this easily created class of property. It was difficult, besides, for the local authorities, whose discretion in this regard was absolute, to perceive the limitation of the scope of ordinary commercial competition in respect of such undertakings as that of gas supply. Everybody, so to speak, wanted a franchise; and nobody wanted anybody else to have one. The local authorities (composed of commercial and professional men) knew that some sort of inducement was necessary to prevail upon people to sink money irrecoverably in a gas undertaking; and at the same time they felt that competition was the only security for the proper conduct of the business. Less instructed public opinion did not perceive the necessity for shielding any enterprise from competition. The mere fact of a franchise—an exclusive franchise—being a valuable asset for an undertaker, blinded the public to the consideration that, without some such asset, there could be no undertaking at all. There also arose the puzzling question, still with us, as to whether a valuable franchise or licence should be paid for, and, if so, in what manner. To ask this first question, is to elicit a loud answer in the affirmative from the cock-sure politician of the street corner and the trashy newspaper. Take the present English political question, already mentioned, of the licensed trade in drink. This is how a London newspaper put it last week: "Every year the State presents 'the trade' with almost uncounted wealth. It is the publican's unearned increment, the product of a monopoly created for him by the State, to which he has no more title than any other man, except that he asks for it, and the other does not." Then the statement follows that the value of the licences in the London County Council area is 60 millions sterling, all given *gratis;* and the indignant query is put: "Why should these vast sums of money go into the pockets of private individuals?" Why, indeed! What easier than to tax this huge vested interest in licences, and pay off the war bill, or endow an old-age pension scheme with the proceeds?

The answer to this contention is not easy to make convincing without going to the very bottom of a deep economic principle. To begin with, Where is the valuation of franchises or licences to trade or professional calling to stop? Is not a physician's diploma, a clergyman's admission to orders, an auctioneer's licence a franchise? Time was when every privilege or charter capable of profitable employment had to be paid for. It is not so long ago that Her Majesty's commissions to positions in the army were sold. This was the last vestige of a once general system; and experience condemned it. Enlightened opinion, it may shortly be said, is against the principle of the "purchase system," for more reasons than can be repeated here. In matters of business, moreover, which are done for profit, the undertaker always charges all his working expenses before he strikes his profit; and the cost of a concession never comes out of profits. Yet it is not true that holders of franchises or licences get this privilege for nothing, even where no direct charge is made for it. They have, in the first place, to render the service in respect to which the franchise is given—which is really the best and the only proper acknowledgment they can return to the community at large. In all cases, moreover, licencees are required to submit to certain obligations to which absolute free trade would not consent. Still, it is difficult for the small shopkeeping mind to grasp the economics of this matter.

Consequently, when the first Company proposing to supply gas in the City of New York, being incorporated by the State Legislature on March 26, 1823, with a share capital of $1,000,000, applied to the Board of Aldermen for an exclusive privilege for thirty years of laying mains in what was then all the city, there were many heart-searchings as to the terms upon which so immensely valuable a franchise should be granted. [We obtain the facts of this narrative from "A History of Public Franchises in New York City," by Gustavus Myers, appearing in the March number of "Municipal Affairs"—a quarterly publication of the New York Reform Club.] The city authority granted the franchise in the terms asked for; only stipulating that the street lighting should be done by gas at not exceeding the old oil-lamp rates, that the mains should be of cast iron, and so forth. The grant was strongly attacked by a ratepayers' party opposed to the aldermen, who denounced the granting of exclusive franchises. This view became popular; and in 1849, when the New York Gas Company's franchise was extended to nineteen years from 1853, nothing more was said about the privilege being an exclusive one. When New York was first lit with gas, in 1825, the price to the ordinary consumer was $10 per 1000 cubic feet. It is now one-tenth of this figure—a progress which does not compare unfavourably with the course of gas prices in the United Kingdom for the same period.

The business and profits of the New York Company appear to have flourished and grown with the increase of the district in population and wealth. In 1833, the Manhattan Gaslight Company was formed, with a capital of $500,000, and obtained from the Common Council the privilege of the highways to the north of the older Company's district, and also apparently a concurrent privilege in part of the latter area. These privileges were not exclusive. There was no payment for them; the city officials being solicitous only to get cheap public lighting, and to keep the gas-works at a respectful distance from the then city. With the advent of the second Company, the price of gas fell to $7 per 1000 cubic feet; and matters went on quietly until 1848, when the consumers agitated for a Municipal Gas Department. The two old Companies were so badly scared at the prospect, that they dropped their price by one-half. This step did not hurt them much; and the Manhattan Company, having the growing outlying district, found it necessary, by 1855, to ask the Legislature to increase their capital to $4,000,000. This needs some explanation. It has been stated earlier in this article that American gas companies do not have anything corresponding to our Special Acts of Parliament. This is true; but, as financial associations, they must register themselves according to the State laws, which, in New York, give the Legislature power to deal with applications for an increase of capital. Thus in the Manhattan Gas Company's case the Legislature only consented to the proposed increase of capital on the condition that within a year the price of gas should be $2·50 per 1000 cubic feet. This, be it understood, was not a maximum, but an actual rate. It is the first example of anything like a statutory regulation of an American gas company's selling price; and the precedent has been followed ever since. The Company submitted, but tried to make things even by clapping on a meter-rent, which brought the price of gas up to $3 per 1000 cubic feet. In 1867, the Legislature abolished meter-rent in the State. It is also important to note that these early New York Gas Companies were districted from the first; so much so, that the Harlem Company (formed in 1855) proposed to supply only the scantily-built region, as it was then, lying to the north of Seventy-Ninth Street. In this Company's franchise, however, was inserted a clause reserving the right on the part of the Municipality to acquire the real estate and plant at any time at cost price, with an addition of 10 per cent.

In the year 1858, the first explicitly competing Gas Company was organized, under the name of the Metropolitan Gaslight Company. After a short experience of conflict with the Manhattan Company, however, the new comers effected a strategic retreat to the vacant territory lying north of the Manhattan and south of the Harlem districts. By this move, all the city area became districted between the Companies named, each bounding the other and being bound on the north, with the two river fronts on its flanks. The price of gas generally was $2·50 per 1000 cubic feet, with meter-rent as already mentioned. Then came the war; and in 1862 a census of the gas industry was taken for the purpose of levying a war-tax of 15 cents per 1000 cubic feet manufactured. The New York Companies were strong enough to surcharge this amount on the consumers. This proceeding made the Companies very unpopular; and an abortive agitation again sprang up for municipalizing the supply. With this era, or rather during the following year (1863), the first chapter of the history of the Gas Supply of New York by non-competing, districted Companies closed. It was followed by a period of corrupt trafficking by city officials and speculators in gas franchises, during which the American systems of city government and gas supply regulation exhibited themselves at their worst. But we must now break off for this week.

Pipe Corrosion by the Earth.—Tests of the corrosion of pipes by the earth along the route of the Coolgardie pipe-line have recently been made. Specimens of pipe, both coated and uncoated, were buried at several different points in November, 1898, and they were dug up and examined on the 24th of April last. In all cases the pipe coating was found to be dry and friable, with a thin film of rust in places on the metal under the coating. There was, however, no pitting of the metal. The pieces of uncoated pipe, where buried in sand or clay, were very slightly pitted; but a piece of uncoated pipe buried in the "salt lake pan" was very materially affected—being covered with pits about 0·05 inch deep over its whole surface.

A VISIT TO THE BECKTON GAS-WORKS.

JUST before two o'clock last Wednesday afternoon, a party of the members of the Society of Engineers left Fenchurch Street Station, their destination being the Beckton works of the Gaslight and Coke Company, in which huge establishment they were going to spend two or three hours. Such a privilege as this is not an everyday occurrence; and as the members journeyed to the Gallions Station (which is the nearest point for the railway passenger to alight for the works), they were all very happy in the prospect of viewing the wonders of world-famed Beckton. For a visit of this kind, the party was a comfortably-sized one, numbering all told only thirty. The amiable and energetic President (Mr. Henry O'Connor) was, of course, of the number; and Mr. Perry F. Nursey, one of the old pillars of the Society, and now the Secretary, was also there looking after the comfort and convenience of his friends with the same activity and geniality which we remember as characteristics in days long ago.

Arriving at Gallions Station, the favoured company walked by the footpath across the low-lying land connecting the station and the works. To one of the party, the scene brought to memory incidents and impressions of visits to the works in years past. There was the curiosity with which he first approached this place so far removed from London, and yet upon which London depends in such a considerable measure for its gas supply. There was the fascination, too, with which he first saw the massive plant, the miles of railway lines intersecting the works, and the several diminutive but spirited locomotives darting to and fro, with their long trains of waggons—each and every part of which is necessary to the feeding of this big establishment with, or relieving it of, the material required, spent, or recovered, in the course of the vast manufacturing operations conducted therein. There were also the immense retort-houses, the thousands of retorts, the army of men, the extent of other portions of the plant, and the tact and method that the direction of such a colossal undertaking requires, all claiming admiration then as they do now. But after all it is the magnitude, and that alone, which attracts. To mind came also a walk across the same fields in company with Mr. John West some ten-and-a-half years since, when there were ominous murmurings and discontent among the men, and all the signs of a gathering storm—the irritant (for the moment anyway) then being the new stoking machinery which Mr. West had introduced into one of the retort-houses. The picture of Mr. West, aided by a few raw recruits and the machinery, industriously charging some of the Beckton retorts, with unfriendly, ill-visaged men passing in the neighbourhood, comes vividly to mind as the old house is again seen; and "Blackleg Square" and the other preparations for protection which the Directors of the Company made to meet the threatened insurrection in those days, are likewise recalled as clearly as though they were the happenings of yesterday.

But during this reverie, the party of visitors to the works on Wednesday reached the offices; and there they met with the only disappointment of the day. Through some misapprehension, the Engineer (Mr. T. Goulden), who had been anticipating this visit with pleasure, had expected the party on Thursday, and was temporarily absent from the works. But Mr. J. N. Reeson (Mr. Goulden's assistant) very cheerfully took his chief's place, acted as cicerone, and gave ample proof that he was capable of completely engineering an emergency of this kind. Under his guidance, the visitors saw the chief features of the place; and while they did not by any means exhaust what there was to be seen over the 300 or so acres on which the works stand, Mr. Reeson so traced his steps that the visitors inspected examples of all the plant from the mechanical appliances used for transferring the coal from barges right through to the holders in which part of the make of the gas is stored. By the way, it should be mentioned that those of the party who could not find place near Mr. Reeson found a good guide and friend in Mr. O'Connor, who, having spent three years on the works, was able to furnish much interesting information.

With the visitors, we will start at the beginning. The coal, which is principally seaborne, is brought to the works by steam colliers, and unloaded at two T-shaped piers by hydraulic cranes and lifting grabs or skips. The newer of the two piers (which was completed some five or six years ago) was ascended by the party; and then Mr. Reeson had ample assurance, before many minutes had elapsed, that his new friends were in quest of, and indeed were absolutely thirsting for, knowledge. The pier is a noble structure, jutting out some distance into the river, and its construction possesses much of interest to an engineer. It is fitted with hydraulic cranes, and Hone's self-locking power grabs; and the mechanism and working of these were carefully examined. Fortunately the barge *Camellia* was lying alongside the pier at the time; and a demonstration was made of the action and capabilities of the Hone grabs. A barge containing 1500 to 2000 tons is easily unloaded in about eight hours—the coal, as the visitors saw, being simply lifted from the barges and deposited in waggons running alongside the cranes. The waggons (which have moveable slides for discharging them) are weighed, and made up into trains for transport to any desired part of the works. The visitors also descended to the stage underneath the pier, and examined the system of high-pressure pipes, &c., required to convey the motive power to the cranes from the hydraulic engine-house on shore.

Leaving the pier, the party were able to make a general inspection of the long stretches of overhead railway which lead to different parts of the works where the coal is required for use or for storage. Nearly the whole length of the elevated railway provides underneath a vast store for coal, and that which is not required for immediate use is so deposited. There must be at the present time quite 170,000 tons of coal in stock at Beckton. The hydraulic engine-house next came in for inspection. Here were seen five of Tannett, Walker, and Co.'s hydraulic engines for producing power (about 800 lbs. pressure) for operating the cranes on the pier. At one end of the building is an accumulator; and there is another one on the pier. *En route* to the retort-houses, the party examined the construction of a new oil-tank which Messrs. Westwood and Wrights are now putting up, and which will have a capacity of about a million gallons. Pneumatic riveting and caulking machines which are being employed on the job were the objects of a good deal of attention. Incidentally, it may be stated that the storage of oil for the manufacture of carburetted water gas is at the present time equal to about 2½ million gallons. The first retort-house visited contains 598 mouthpieces; but this was one of the medium-sized houses—the largest containing 810 mouthpieces, and the smallest 480 mouthpieces, or thirty settings of eights. The house inspected is equipped with Arrol-Foulis drawing and charging machinery, and the method of working was illustrated. Of equal interest was the examination of another house in which the whole of the benches are being reconstructed; and, the beds being in various stages of advancement, the inspection was very instructive. Mr. C. C. Carpenter's "2000-day settings" have been adopted for this house; and 30 beds of tens (600 mouthpieces) are being put in. Holman's new patent mouthpieces are being used in this new work; and arrangements have been made for the furnishing of the house throughout with West's compressed-air stoking machinery.

The extent and isolation of Beckton demand that the works shall be in large measure self-reliant in the matter of repairs and maintenance; and for these purposes, the equipment includes a foundry, smiths', fitters', and carpenters' shops, stores, &c. Through some of the shops Mr. Reeson conducted the visitors on the way to view other parts of the manufacturing plant; and in these shops a few useful hints might be collected by other gas engineers. A speciality is made of stamping; all the cross-bars, bolts, levers, catches, iron handles to shovels, and nearly every little piece required on the works in the way of iron fittings being stamped out in the smiths' shop by means of steam-hammers. At Mr. Reeson's request, the men, with the utmost willingness, gave proof positive of the skill and rapidity with which they can turn out such articles as those enumerated. Leaving the shops, the washers and scrubbers were passed; and their respective duties were explained. One of the purifying-houses was inspected; and it was mentioned that each house has its eight vessels. The first pair are filled with lime, the second with Weldon Mud, and the third with sulphide of lime—the fourth pair (which are the catch vessels) being also loaded with Weldon Mud. The condensers were next viewed, and information given as to their action. A walk through the station meter house brought the party to the building containing the pumping-engines which send the gas, at high pressure, through two 48-inch mains to the storage stations in London. The gas-holders also came in for notice; but the largest and most modern one, of 8 million cubic feet capacity, really monopolized attention. The inspection of the water-gas plant formed the *finale* of a very interesting visit; and here Mr. Reeson took infinite pains to inculcate in his visitors' minds a better understanding of the principles of this method of gas manufacture than many of them previously possessed.

Mr. Goulden had kindly arranged to entertain his visitors at tea; and, although a mistake had been made in the date, the resources of Beckton were equal to the provision of refreshment of this kind at short notice. On returning to the offices, the party were exceedingly grateful, after their somewhat tiring, but instructive, perambulation to find that, with considerate forethought, Mr. Reeson had carried out to the fullest extent the plans of his chief for the comfort and pleasure of his guests. Due acknowledgment was made by Mr. O'Connor on behalf of the members; and Mr. Reeson, in replying, said his only regret was that Mr. Goulden was not present, as he had been looking forward with the greatest pleasure to this inspection. About five o'clock, the party, well satisfied with their visit, left these colossal works, with the building up and carrying on of which the names of Evans, Trewby, Beale, Methven, and Goulden will, in a greater or less degree, ever remain associated.

It may be of interest to many readers if we supplement the foregoing with the following particulars: The number of men employed at Beckton varies, according to the season, between 3300 and 5500. There are fourteen retort-houses, containing in all 8404 retorts, and about one-half are operated by power stoking and drawing machines. There are nine gasholders, with a total capacity of nearly 19 million cubic feet; but, at the storage stations, there is accommodation for 35 millions. A winter day's output at Beckton is about 50 million cubic feet of coal gas, and 8½ million cubic feet of carburetted oil gas. The quantity of coal carbonized is, in round figures, 1,150,000 tons per annum, and about 6 million gallons of oil are also used. The works produce about one-half of all the gas supplied by the Gaslight and Coke Company.

SYSTEMATIC KEEPING OF GAS COMPANIES' ACCOUNTS.

THE value of uniformity in the method of keeping the accounts of large public undertakings such as those concerned with the supply of gas will, we think, be readily acknowledged, especially by anyone who has had to investigate them for the purposes of audit, analysis, or comparison. While varying circumstances and differences of opinion have prevented the attainment of uniformity so far as internal official arrangements are concerned, an endeavour was made by the framers of the Gas-Works Clauses Act of 1871 to ensure the presentation of half-yearly statements in one style, by appending to the Act a set of forms which could be easily adopted. Although the accounts of local authorities are not subject to the general suggestions contained in the Act above referred to, some Borough Accountants follow them; and consequently their working results can be more readily compared with those of other authorities whose officials adopt a similar course, as well as with those of statutory gas companies. As regards the form in which the accounts are presented, therefore, it may be said that something like uniformity prevails. In the keeping of the accounts, however, it appears to be lacking. This probably arises from the fact that hitherto no attempt has been made to deal with the scientific principles of double-entry book-keeping in the form of a treatise adapted to the accounts of gas-works. This want it has been the endeavour of Messrs. Brearley and Taylor to supply, in the work which, as already announced in the "JOURNAL," they have just published.* The book is the result of a combined experience of gas and other accountancy extending over thirty-three years; and though the system set forth therein necessarily differs in several important details from that employed in many gas-works, the authors believe there is little that cannot be adapted to all.

The treatise is divided into two parts—the first consisting of three, and the second of thirteen chapters—with a copious appendix. In Part I., what are called the "record" books—the registers of shareholders, transfers, and mortgages, &c.—are dealt with, and some illustrations of the books and forms referred to are given. Part II. opens with a few preliminary remarks on double entry and an explanation of terms. These are followed by chapters dealing exhaustively with the books and forms necessary in carrying on the business portion of a gas company—viz., purchases, sales of gas, residual products, and fittings, the various books employed, balancing, the report and balance-sheet, &c. The subsidiary books are illustrated and explained together, and distinct from the financial books. The transactions with which the authors illustrate the latter are such as are met with in every-day work; the only difference between the set included in the treatise and an actual set being that the former have been abbreviated for conciseness. Facility in tracing the transactions is obtained by folioing the books of entry and the ledgers (in the set) consecutively. By this means one can tell where to look for the posting of any particular entry by merely following the folio. The tracing of the postings is simplicity itself, for the illustrated set of books is kept apart from the explanations and descriptive matter, although the folio of each book or ledger account is given with the latter for reference. Facsimile illustrations of actual business forms are furnished throughout the treatise. The frontispiece is a concise chart, showing the entire scheme of a gas company's financial books; the debit and credit being indicated by differentiated lines and arrows. The text has been carefully divided into paragraphs, which are numbered to facilitate reference. The important duty of "balancing the books" is illustrated by four different methods. In addition to carrying the transactions right up to the revenue account and balance-sheet, the final results are shown as they would appear in the statement of accounts as printed and sent to the shareholders. The authors have been so desirous of having the statement exactly like an actual one, that they have had it bound in a coloured cover, so as to distinguish it from the other contents of book. In the appendix, the book-keeping necessary for carburetted water gas, oil used for enrichment, laboratory tests, and the various funds which are created by the raising of capital by local authorities, are dealt with; while several very useful forms for outstanding gas accounts, applications for cookers and slot meters, &c., are included.

It is obvious that the extremes of large and small undertakings render difficult the task of preparing such a work as that of Messrs. Brearley and Taylor; and while being exhaustive, there is little in the book that will not, we believe, be found applicable to each class, in a greater or less degree. The main object of the authors has been to produce a handbook of gas companies' book-keeping. It is the first attempt—at all events, the first published attempt—to treat of this kind of book-keeping all round; and the work should prove really helpful to all whose knowledge of gas accountancy is limited, and who are desirous of extending it. Its careful study will reveal to the uninitiated how the various books in use by gas companies are linked together, until the results of the operations are presented in the condensed form of the annual or half-yearly statement of accounts.

* "Gas Companies' Book-Keeping: A Practical Treatise on the Keeping of Gas Companies' Accounts." By John Henry Brearley, Engineer, Manager, and Secretary of the Longwood Gas Company, and Benjamin Taylor, F.I.P.S. (Honours), Accountant. London: Walter King; 1900.

DONKIN ON THE GAS-ENGINE.*

THE previous edition of Mr. Bryan Donkin's well-known work upon the gas-engine bears the date 1896, which is ample justification for the publication of a Third Edition of this instructive book. It has been our pleasurable duty to introduce every edition in due course to the public reached by the "JOURNAL;" and we have had many occasions for referring to the volumes, as placed in the handiest corner of that book-shelf which contains the books that are tools. This avowal will probably be taken by the author as the greatest of all possible compliments. It is, in point of fact, impossible to have too frequent editions of a good book relating to so active a department of mechanical industry as the production of gas-engines. When a competent authority undertakes to write a text-book of this character, he ought to bind his publisher to issue only such a number of one edition as may be reasonably expected to necessitate another before very long. The historical portions of such a book should be as full and as accurate as possible to start with, so as not to require much alteration. With every fresh edition, the historical chapters may be increased by one, as the newer developments of the subject supersede the older. Mr. Donkin has worked on these lines with some consistency, though he does not appear to have realized their binding force throughout.

Since his previous edition appeared, gas-engines have developed chiefly in one direction. They have grown larger, so as to more directly challenge competition with the steam-engine; and they have been adapted to work with combustible gases of low fuel value, especially the gas evolved by the blast-furnace during the reduction of iron ores. Mr. Donkin has accordingly followed this line, in his prefatory remarks; and the switching-off of the new branch from the old text is very noticeable. It would have been easier, probably, to have rewritten the preface altogether. This would have spared readers the shock of reading that "in France, where both gas and oil are more expensive, they gas [and oil engines] are not so much in request." This observation was never more than partly true of French practice, even under past conditions, and in the days of small engines. There has never been a period in the history of the gas-engine, from the time of Lenoir onward, when French engineers were not working upon its development; and French engineering has had most to do with the direct utilization for the production of power of blast-furnace gas, and with the application of the poorest class of artificial fuel-gas to the working of large motors.

Five years ago, the industrial future of the gas-engine appeared, in expert opinion, to hinge upon the possibility of so improving the design as to avoid the great waste incidental to the cooling of the working cylinder. All these years have passed, and the gas-engine has been made both bigger and smaller than ever. It now fills the vast field open for the employment of prime motors ranging from 1500-horse power to the little engine that drives a tricycle; but the cylinder still has to be cooled. The much-desired (in theory) hot-cylinder gas-engine has not come into sight. Practically, the gas-engine cylinder is hot enough, in all conscience. The initial compression of the charge has risen to 250 lbs.; and the "scavenging" of the cylinder is much better done. A cylinder lubricant has been found which stands even this hot work. The improvement has come, not from the direction looked for, but in the economizing of the charge and the cheapening of the fuel. Thus it is practicable still to lose the heat dissipated by the cooling of the cylinder, and yet run the motor to better economic advantage. Another disappointment is recorded by Mr. Donkin, in the non-appearance of a rotatory or "impulse" gas-engine. This, having regard to the success of the Laval and Parsons steam-turbines, of which Mr. Donkin is not unobservant, is rather more to be regretted than the other. And, as yet, there is no marine gas-engine. Apart from these failures of invention to fulfil expectations—which, of course, are not peculiar to gas-engine practice—the gas-engine has, during the past five years, made more headway than either steam or air motors. This is the more remarkable in view of the circumstance that the gas-engine cannot be compounded. Nothing else than pure mechanical engineering has proved competent to increase the intrinsic and relative utility of the gas-engine.

So much for general considerations. Coming down to the particular contents of Mr. Donkin's book, we could have wished he had rewritten his first chapter, with the object of getting rid of the old-fashioned term "explosion" as being something different from "expansion." In many places where the author writes of the "explosion" of the charge, he means its ignition. Comprehension of what goes on in the working cylinder of a modern gas-engine would be facilitated if the term "explosion" were relegated to the history of the Otto and Langen motor, which really did depend upon an explosion for its movement. It is impossible, in the case of modern gas-motors, to separate the ideas of explosion and expansion of the driving charge. Some of the author's historical matter has been re-arranged. In his account of the development of the Otto engine through the dual branches of the Deutz and Crossley firms, Mr. Donkin has brought his statistics up to date, even more thoroughly than

* "A Text-Book on Gas, Oil, and Air Engines." By Bryan Donkin, M.Inst.C.E., &c. With 149 Illustrations, and Selected Tables of Trials. Third Edition, Revised and Largely Rewritten. London: Charles Griffin and Co., Limited.

his technical matter. Surely, a modern illustration or two might have been found for this section; and we should not have blamed the writer if he had gone very fully into the minor improvements that must have been introduced in the Crossley manufacture since 1894.

D scriptions of several makes of gas-engine once known to Fame are left out of this edition, and their successors are duly catalogued. Students of Mr. Donkin's pages are prudently left to make their choice among the crowd of aspirants for patronage on the score of having improved upon the Otto type. From this list, the reader is taken to a chapter on French gas-engines, which is one of the best in the volume. We are told all that it is necessary to know about the so-called "Simplex" engine, and why the makers have adopted electric ignition. It is much to be regretted, by the way, that Mr. Donkin has fallen into the weakness of literally translating the French technical term *haut fourneau*, and throughout his book speaking of engines using "high furnace" gases. He should have remembered that English people really know nothing of "high" furnaces. Blast-furnaces they do know; and it is to the utilization of blast-furnace gas that the big gas-engine is specially called in this as in other countries. "High furnace" smacks of the amateur.

The chapter on German gas-engines is not quite up to date. The blocks are mostly old, and the matter does not convey the impression that the intense preoccupation of German physicists and engineers with the problem of cheap power production has been adequately watched, and the results followed. The chapter on fuel-gas production is newly written, for the most part; and the actually surviving processes for making it are fully noticed. We fancy, however, that the water-gas men will protest against the statement, on p. 164, that the average heating value of water gas is 106 B.T.U. per cubic foot. This must be a piece of sheer carelessness, because on the opposite page Mr. T. O. Paterson is cited as having made some experiments with water gas which had a heating value of 276·4 B.T.U. per cubic foot. It is waste of space to reproduce, as Mr. Donkin does, information about the "Strong" water-gas system, or any other fossils of the order. We are not going to name them; but living processes are the only ones deserving of an instant's critical notice. There are dozens of pretty-looking devices of the kind, on paper, called by fond parents by various question-begging titles, which are not worth looking at outside a museum.

For one luminous statement Mr. Donkin deserves to be thanked and remembered with gratitude. It occurs on p. 203, after a table of heating value of various gases, and runs as follows: "The low heating value of the gas, as here shown, does not affect its efficiency in a gas-engine. The lower its calorific power, the higher the compression it will bear without danger of spontaneous ignition, or sudden explosive shocks. As is now well known, the thermal efficiency of an engine increases within certain limits with the degree of compression; and it is towards this higher compression that the efforts of gas engineers are continually tending." This clears up the field wonderfully.

Having given Mr. Donkin this high meed of praise, we are free to point out his grave omission to adequately criticize the Westinghouse gas-engine. This ought to have come in somewhere about or before his p. 215, where he discusses the question "whether large gas-engines, at the high temperatures and pressures developed in the interior of the cylinders, and their comparatively high piston speed, may be relied on to run safely and steadily for a long period without undue wear." True, he mentions the Westinghouse motor, but almost as an afterthought, or at any rate after his criticism of the whole class of motors had been finished. Yet this is just the place where the Westinghouse motor ought to have been noticed, because it discards the "hit-and-miss" system of governing, and governs by varying the quantity of the charge. There are no miss-fires. All that Mr. Donkin has to say about this motor is that "great regularity in running is said to be obtained." We submit that this is not nearly enough. Mr. Donkin puts the Westinghouse manufacture in the same category as half a score of commonplace American copies of Otto engines that the majority of his readers are never likely to hear of. This, again, is not fair. The besetting weakness of text-books is the lack of due observance of proportion. Nobody can usually learn from them whether the thing described is a mere curiosity, or is the most important commercial success of the time. It may be said, of course, in reply to this complaint, that science knows nothing of the volume of sales; but business men, and technical students, have to think of this element. Everybody "in the know," at the present day, is cognizant of the state of affairs as between the Otto and the Westinghouse types of gas-engine. No others count. But if the essentials of the Otto type of motors are adequately discriminated in Mr. Donkin's work, those of the Westinghouse motors certainly are not. The name does not even appear by itself in the index. This is a loss to the whole work, and clearly gives it an obsolescent aspect before it gets into circulation.

The Gas Exhibits at the Paris Exhibition.—Mr. C. E. Brackenbury, Assoc.M.Inst.C.E., has written a report for the London Chamber of Commerce on the gas exhibits at the Paris Exhibition. It may be remembered that the Chamber recently appointed an Exhibitions Committee to inquire into the representation of British interests, and to consider what steps, if any, should be taken to safeguard them.

PERSONAL.

It will be remembered that Mr. CORBET WOODALL left England on Aug. 25 for a visit to the States, and thence to the Straits Settlements to fulfil a professional engagement. His numerous friends in the gas industry will be pleased to learn that he had a pleasant and interesting trip from New York to Vancouver, and that he arrived safely at Yokohama on the 24th ult.

On the occasion of the distribution of the awards at the Paris Exhibition, the following promotions were made in the Order of the Legion of Honour: To the grade of Commander, M. TROOST, Chairman of the Paris Gas Company. To the grade of Chevalier: MM. LÉON BERTRAND and AUGUSTE LÉVY, Engineers of the Paris Gas Company; M. BESNARD, member of the Jury of Class 75; and M. CHAMON, Director of the Compagnie pour la Fabrication des Compteurs, President of the Chambre Syndicate d'Eclairage et de Chauffage par le Gaz.

OBITUARY.

The death is announced of Alderman J. F. WILEMAN, who for several years has been the Chairman of the Staffordshire Potteries Water Company. He has been in failing health for some time; but the immediate cause of death was heart disease.

We regret to record the recent death, in his 62nd year, after a short illness, of Mr. WALTER W. MONK, who for about ten years was Engineer and Manager of the Bournemouth Gas and Water Company, having previously held the position of Manager of the Port Louis Gas-Works. Acting under medical advice, he left England in 1890 for Australia, and for a few years represented Messrs. C. & W. Walker in that colony; but he returned some six years ago. At the time of his connection with the Bournemouth Company, Mr. Monk was a member of the South-West of England Association of Gas Managers; and those who attended the meeting of the Association in that town in September, 1884, will remember the hospitable reception they met with at his hands, and the personal attention given by Mrs. Monk and her daughter to the arrangements for the comfort of their guests.

Lectures on Gas Manufacture.—We have received a copy of the syllabus of a special course of lectures on "Gas Manufacture" which Mr. Walter Grafton, F.C.S., will deliver to students at the Regent Street Polytechnic, commencing on the 3rd inst. The lectures, so far as is practicable, will be illustrated by experiments and apparatus. Glancing through the syllabus, its comprehensiveness is striking. We can detect nothing in the way of omission from the site of a gas-works and the coal used up to the distributing-mains, domestic lighting, cooking, and heating appliances, and laboratory work. The lectures may be commended to those who desire to obtain (for a modest fee) a good general knowledge of the subject, and who intend sitting at the City and Guilds Examination.

North of England Gas Managers' Association.—The 47th half-yearly general meeting of the Association will be held in Durham next Saturday, under the presidency of Mr. E. H. Millard, the Engineer and Manager of the Durham Gas Company. We learn from the circular issued by the Hon. Secretary (Mr. J. H. Penney) that the members and associates will meet at the Gas Office at noon, where light refreshments will be provided; and the business will be proceeded with shortly afterwards. It will consist mainly of the delivery by the President of his Inaugural Address. By permission of the authorities, arrangements have been made for the members to visit the Cathedral after the meeting. On the invitation of the Chairman and Directors of the Gas Company, the Association will dine at the County Hotel in the afternoon.

Early Instances of Oil-Gas Lighting.—In an interesting article on "Early Oil-Gas Lighting" which appears in the current number of the "Engineer," it is pointed out that three-quarters of a century ago a considerable number of towns in the United Kingdom were illuminated by oil gas; and for a long while much competition prevailed between it and the older system of using gas produced from coal. The oil gas in question was usually made from whale oil—the material which, before any kind of gaslight was known, supplied the wretched little lamps of the public streets. In 1815, Mr. John Taylor, of Stratford, Essex, obtained a patent for the decomposition of oil and other animal substances, with a view to obtain from them an illuminating gas. The patent was acquired by Messrs. Taylor and Martineau, who in 1819 put up a small but complete and improved apparatus at Apothecaries' Hall, London. It was capable of producing from 1600 to 1800 cubic feet of gas at one operation—that is, without cleaning the retorts. The whole occupied a very small space, and was therefore thought to be eminently suitable for lighting large houses or factories; while practically very little trouble or labour was required. The gas gave a fine white light, did not contain any sulphuretted hydrogen unless bad coke was used, or require purification beyond passing through clean cold water. It was estimated that a gallon of common whale oil would produce 90 cubic feet of gas, though further experience showed that 80 cubic feet was nearer the average. Other forms of oil, or liquid grease, were also used, some of which were cheaper than whale oil; and the perfect practicability of obtaining an excellent light was soon put quite beyond question.

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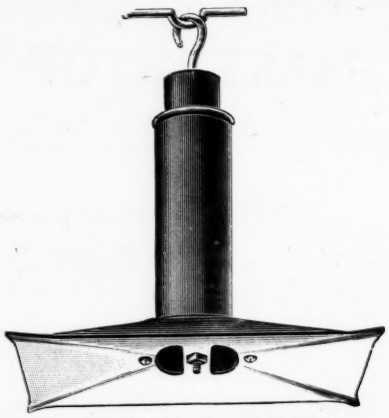

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A NEEDFUL NOTICE

TO ALL WHOM IT MAY CONCERN.

We hereby intimate to Chairmen and Members of Gas Committees, Engineers and Managers of Gas-Works, that we have **PURCHASED THE BUSINESS AND PATENTS OF THE AUTOMATIC COAL-GAS RETORT COMPANY, LIMITED,** Westminster, London, and are now the Sole Owners of the Patents of the pre-eminently successful system of Self-Acting Conveyors and Elevators in combination with the Storage Hoppers, the Measuring Chambers, and the Charging-Shoots, forming together the much admired and happily-designated "powder-pouch" method of charging Inclined Retorts, now in operation, or in course of erection, at—

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NOTES.

Expanded Metal and Concrete Construction.

Mr. A. T. Walmisley read a paper at the British Association meeting on the "Use of Expanded Metal in Concrete," which he treated as an improvement on the Monier and similar systems of reinforced concrete construction. The author worked out the principle of the system, and gave many particulars of tests of beams and slabs prepared in accordance with it. He gave the preference to expanded-metal reinforcement for concrete, because it is lighter for the ultimate strength attained than any system of bars or wires, and moreover demands less care in the adjustment. Mr. Walmisley relied largely upon the results of tests of the system carried out by Mr. A. Baker, of Beckton, under Mr. G. C. Trewby's direction. It has since been used extensively at Beckton, with satisfactory results on a large scale. Mr. Walmisley notes that the introduction of metal into concrete as a tensile element, has become generally accepted as a point of modern engineering construction. Hitherto the principle has chiefly been used in cases where the steel framework of the floor construction has already been designed. It is remarked that the best and most economical results would be obtained by a disposition of framework calculated to suit the carrying power of the concrete with the aid of expanded metal, whereby the user could employ concrete of a wider span than when employing plain concrete. The full text of the paper appeared in the "Builder" for Sept. 15.

The English Trade in Russian Petroleum.

According to the "Petroleum Review," a new era has dawned for the English trade in Russian petroleum. This result is claimed to be due to the operation of natural forces and influences, which are far more potent than fiscal manœuvring or market manipulation. In the natural order of things, it is pointed out, the export oil trade of the United States is being overtaken by that of Russia. The American importation still leads, with a total of upwards of 93½ million gallons for the first eight months of the current year. The Russian importation, however, has crept up to 59¾ million gallons, and is still growing. The first section of the long pipe-line which is to connect Batoum with the open sea has been completed and brought into use; and when it is entirely finished, the oil-consuming world is to see wonders. Meanwhile, much is expected from the circumstance, now announced, that the interests of Russian oil in this country are brought under the control of one company, who are going to establish an organization for transporting and supplying the products which will rival that of the Standard Oil Company. It is remarked, in justification of this combination, that petroleum is a product the cost of purveying which is in inverse ratio to the quantity distributed. A wide and ramified system of conveyance and supply is thus necessary to achieve a substantial result, to effect the greatest economies, and to bring the price of oil as low as possible.

Moving Stairways and Platforms.

The attention of works managers may be drawn to the rapid modern development of the idea of the saving of labour by mechanical elevators and conveyors, which is being extended to include human beings. The conviction is being forced upon practical-minded persons in commerce and industry, that the more saving of every form of unnecessary muscular labour that can be effected, the more and better work will be done to the desired purpose. One of the oldest and most familiar of muscular efforts is that of walking about and going up and down stairs. It is difficult to realize how much energy is commonly wasted in this way; but it is beginning to be understood that every man in his ordinary working trim, whatever his occupation, is only able to expend a fixed amount of energy during his hours of daily labour. If this amount is regularly or often exceeded, rapid deterioration of the human machine follows. To make a working man run about unnecessarily, or go up and down stairs often, as part of his day's work, is to use up energy that could be more profitably employed. Consequently, there is a greatly increased employment of lifts in all modern offices and commercial buildings; and this labour-saving device is being supplemented by moving stairways and travelling platforms. At the Crystal Palace, the galleries hitherto almost a desert because of the disinclination of tired sightseers to mount stairs, are being rendered more accessible by means of what is called the Reno Inclined Elevator. This kind of appliance has a future; for it avoids the interruptions and waits inseparable from the use of the ordinary lift. There are many situations, moreover, in which a travelling platform of people and goods would save much tramping to and fro.

A Furnace for Burning Coke Dust.

An interesting American consular report relates to the working of an invention of Paul Cornelius, a German, for effectively burning the finest coke dust in a boiler-furnace. By this device, the fuel has to be burnt in furnaces built separately from the boiler; the ordinary size for the fireplace being 10 feet by 4 feet. In addition, there is required a fan-blower, driven by an electrical motor, or its equivalent, of about ½-horse power, which drives air into a hollow iron chamber placed at the rear end of the furnace, where the heat is most intense. Into this chamber one end of the hollow grate-bars is fitted; the front end resting on ordinary bearings. These hollow fire-bars are round on the bottom, but hexagonal on top, where they are pierced, on all three faces, with holes about 2 inches apart, beginning at the nearest end with a calibre of ⅛ inch, which is slightly increased throughout the length of the bar, so as to equalize, as far as possible, the delivery of the air. Not all the bars are hollow; these being interspaced with solid bars to help take the weight of the fuel. The idea is that the intensely heated air, being driven upwards in three rows of jets at different angles, keeps the whole bed of fuel in a highly incandescent state. Such a grate will burn with a white heat coke dust, the fine screenings of broken coke, or any description of carbonaceous rubbish that ordinarily goes to form roads and footpaths. The hollow grate-bars are cast in 3-feet lengths, with flanges for bolting together to form any desired length of grate. It is to be expected that there will be a good demand for all kinds of rubbish-burning grates for some time to come; and the claims made for this simple arrangement may well be tested. It does not appear to exhibit any specially novel feature.

Self-Fleeting Rope-Drums.

All hoisters and ironwork constructors have experience of the troublesome feature of drum-winding known by the name of the "fleeting" of the rope. It means the creeping of the rope, as it is being wound in, from one side of the drum to the other, by reason of the coils following one another always in the same direction. The two usual ways of dealing with this phenomenon, when the conditions do not permit of the use of a drum large enough to take all the length of hoisting rope, are either to stop heaving and "fleet over," by shifting the turns backwards—the load being meanwhile sustained by a tie on the main cable—or by sharply coning the drum, which causes the rope to slide sideways by itself. The latter is the safer expedient; but it causes a great deal of wear upon the rope—thus materially shortening its life. A better device is described in "Mines and Minerals." This consists of a pair of pulleys or drums placed tandem-wise, each having several grooves upon its face. Call these drums A and B, and number the grooves 1, 2, 3, 4, in order from the winding-on to the winding-off side. The rope is threaded underneath drum A, and winds into groove 1 of drum B, lying here for half the circumference, and then passing back underneath the pulleys and winding into groove 2 of drum A, which it likewise traverses for half a circumference to the upper side of the pulleys, whence it passes to the next groove of drum B. Thus the rope has an arc of contact of only one-half of a circumference upon each drum, for each complete round turn. Every round turn is divided between two drums, instead of being completed upon one. Hence there is no fleeting, because the turns do not complete themselves, and there is no riding nor slipping sideways. The friction of the rope is not quite so great on the two drums as on one; and another round turn or two may be needed to give the same grip. But this is a small consideration.

COMMUNICATED ARTICLES.

THE UNPROFITABLE CONSUMER.

By Norton H. Humphrys, Assoc.M.Inst.C.E., F.C.S.

It is somewhat disappointing to find that the article on slot consumption and paying averages, communicated to this column by Mr. George Helps (*ante*, p. 523), has not been successful in drawing some discussion or expressions of opinion from the friends of the slot-meter consumer or from the advocates of the system, and especially from those who go so far as to claim that there should be one price for all—slot or ordinary—and that there should not be an extra charge on the slot-meter consumption. At the present time, when the unusually high price of coal leads the gas manager to scrutinize the expenditure side of the revenue account more anxiously and closely than ever, it is desirable that the slot meter should be placed upon its trial, to see whether it really does, in practice, come up to the standard of the paying average. So long as things are going well and easily, there is not much trouble in getting permission to incur outlay, if there is a reasonable prospect of further business; but when there is an awkward hiatus between the amount required for full dividends and the available balance for the purpose, the new proposal is more severely criticized, and there is a desire to know, not only what the proposed outlay will be, but also the actual return that may be looked for. A loading composed of unprofitable consumers that might escape notice at ordinary times, now becomes an important item. While new business is welcome, it is especially desirable that it should be, if anything, more remunerative than the existing lines; and certainly it should not be less so.

The noticeable sympathy between the topics discussed by gas managers in America and those that attract attention here, to which I have previously alluded, is again illustrated. For within a day or two of the publication of Mr. Helps's opinions—which are more remarkable as going beyond the usual standards of the number of appliances put out, or the quantity of gas consumed by them, than for specific considerations of profit and loss—Dr. Powers was asking the members of the Pacific Coast Gas Association, assembled at San Francisco, for some information, not only as to the number of stoves distributed and the quantity of gas used, but as to the actual position of the stove department as a paying concern. Undoubtedly there were increased sales,

which might be taken to mean increased profits; but he wanted to know the amount of net profit remaining, after paying all expenses, and suggested whether, after charging the gas-stove department with all expenses incurred on its behalf, there might not be a necessity for a subsidy from the general funds to meet a deficiency, rather than a balance available for profit. This criticism, being addressed to gentlemen who spend hundreds a year in advertising, or give stoves away *gratis*, might perhaps have greater force in California than in England. But it also applies here, for there is a noticeable tendency to incur special outlay in order to obtain new business, and this without actual proof that the new business may be expected to be remunerative. So the lines of reasoning laid down by Mr. Helps, which admit of an answer to Dr. Power's question being prepared from the accounts of any particular undertaking, are particularly pertinent under present circumstances of working; and they may be applied to any kind of special outlay undertaken with a view of opening up new lines in gas consumption. In place of "slot meters" we may read "cooking-stoves," and the arguments still hold good.

The practice of insisting on a written agreement from every customer has been dropped; and, on the whole, gas companies have done better since they discontinued it, as in some sense it involved thrusting their Act of Parliament upon public notice, and was no doubt largely concerned in securing for them the title of "monopolists." But it is quite possible for the pendulum to swing too far in the opposite direction; and one cannot go very deeply into questions of the kind now under consideration without being confronted by the fact that, while the company on their part accept onerous responsibilities, the consumer incurs no corresponding liability. In laying on a supply of gas, the company have to guarantee a great deal; but the consumer guarantees nothing. In putting down a 10-light meter, with its appropriate service-pipe, the company incur the liability of keeping on a continuous supply for 168 hours per week up to the full capacity of the meter. It would seem that, in order to preserve the two-sidedness which is a necessary feature of a fair bargain, the consumer should also be prepared to guarantee a fair minimum consumption. But he can please himself whether he uses gas for one hour or less, out of the 168, and at best cannot be compelled to do more than make a colourable imitation of using gas. The excess capacity of service and meter that the company are called upon to provide is enormous. A 10-light meter, working at full nominal capacity, would pass more than a million cubic feet a year; but in actual practice, the average annual consumption is less than 100,000 feet. Yet there are those who advocate free meters.

If a gas company decide to assist theconsumer by providing a slot meter, stove, or gas lighting appliances, they make a known and definite addition to their obligations. They have to guarantee the interest on the capital so invested, and to take the risks of depreciation. But the consumer's position is not altered. Every working man may have, not his three acres and a cow, but three gas-burners and a stove. The only way of finding out how far the arrangement is likely to be remunerative to the gas company, is to try the experiment for a twelvemonth, and then strike the average, and see if it is a "paying one." The success or otherwise of the enterprise depends solely upon reaching a paying average; and whether this is attained or not rests entirely with the inclination of the consumers. It should be the business of every gas manager who introduces any scheme that adds to the expenditure per consumer, to ascertain his position in respect to this important factor. If it has not been secured, the question for consideration is the best means to adopt in order to convert loss into profit.

One accredited method of proving the success or otherwise of a new departure, is to compare the most recent available set of accounts with those of previous years; and to some extent the balance of income over expenditure is an indication of the prosperity of the concern. But unfortunately the times are not favourable to such a comparison, as this item is affected by variable factors that are outside the control of the management. The market prices of coal and other necessaries have been steadily rising for some years; and it is not always good policy to advance the price of gas in sufficient proportion to maintain the *status quo*. Many who read these lines have experienced the annoyance and disappointment attending upon finding that the results of some improvement involving a large amount of time and trouble have been wiped out of the accounts by these means. They have introduced, let us say, regenerator firing, and have incurred considerable outlay on the faith of improved returns. After the usual difficulties and anxieties, the expected results are fully secured. But meanwhile up goes the price of coal; and the additional profit, which should appear in the form of increased net revenue, simply goes into the pocket of the coal suppliers. It is difficult to satisfy everybody that more profit has been earned, when a smaller return is shown in the profit and loss account. In a similar way, a comparison of the accounts for the year ended June 30, 1900, with those for the year ended June 30, 1896, is not likely to afford much useful information as to the success or otherwise of a new departure inaugurated in 1897. Yet we naturally want to know whether the introduction of the slot system has yielded a profit commensurate with the special expenses, trouble, and risk incurred in connection with the establishment of this new line of business. Whether equally good results might possibly have been attained by less costly methods, and whether the new venture has not been allowed too prominent a place, to the detriment of other means of keeping and increasing business—such, for example, as a well-arranged maintenance scheme for incandescent lighting. One company may be very enterprising, and devote all their available strength to obtaining new business, while another may rather favour attention to the existing connection, and to keeping together the business already secured; and it is possible that the second may make as good a showing as the first.

A very usual joke at a Christy Minstrel entertainment is for "Massa Bones" to step forward, after a well-merited round of applause accorded to an artistic rendering of a chorus or orchestral performance, and, by elaborate bowings and gesticulations, to accept the same as a recognition of his own individual abilities. The slot meter stands in a somewhat similar position, when it is credited with going out by thousands, while the ordinary meter only went by hundreds. The introduction of the slot also means, in most cases, the inauguration of a grand new policy. It is a very long jump from unassisted gas-fitting and long-period irregular payments—the benefit of gas could not be obtained on any other terms—to short-period regular payments and fittings without trouble or initial cost. Under the ordinary arrangement, the intending consumer is practically loaded with all responsibility in respect to fittings on his side of the meter. He has to employ a gas-fitter, to exercise a certain amount of supervision, and then to foot the little bill. In some cases the gas company assist him in this matter to the extent of being prepared to carry out the gas-fitting at his expense. Then as regards payment for the gas consumed, until the introduction of the slot meter the idea of doing business on any other than "quarterly terms" was regarded, with very few exceptions, as impracticable. And to talk of quarterly payments does not quite cover the whole ground, as the impression is conveyed of *equal* payments, as is the custom with regard to the rent of a house or field. But the quarterly terms for gas really come, in practice, to paying one-third in January, one-third in April, one-sixth in July, and one-sixth in October. Thus a consumer using £10 worth of gas per annum is asked to pay about £3 in January, and a similar sum in April. There is no trouble about the summer instalments. But the small consumer and the weekly wage earner find their January and April payments are a heavy burden, coming just at a time when other expenses are highest and wages lowest. With the slot system, there is no heavy initial expense in the form of the gas-fitter's bill; and in regular working there is no quarterly bill looming in the distance, and no necessity for scraping together comparatively large sums during the winter months. As Mr. Helps appropriately points out, there are other ways of securing these advantages, apart from the slot meter; and in assessing the benefits claimed to have resulted from its introduction, it is right to discriminate between those due to the special feature of the appliance, and those due to fittings with no initial cost and to short-period payments.

There is a point where every consumer of gas—and, for that matter, every purchaser at any shop—ceases to be a source of profit. Let us suppose that a customer's account is subject to steady and continuous decrement. After a time, a point will be reached when the custom is so small that, to use everyday language, it is not worth having. The grocer would decline to sell sugar or soda by the ounce; and the publican would not care to retail beer or spirits by the halfpennyworth. The reason why they refuse to do so is that every transaction involves a certain special outlay, if only an assistant's time for a few minutes. In connection with the sale of any commodity, there are three classes of expenses—viz., liabilities, such as rent, which are entirely independent of the amount of business done, and have to be paid in any case; expenses, such as the purchase of materials, which are in direct ratio to the amount of business done; and expenses that vary according to the number of customers, such as the serving and delivery of goods. In regard to the supply of gas, there are certain establishment charges which must be met, even if the company did not sell 1000 cubic feet of gas. There is the cost of coal, wages, purifying, and other items of manufacture, which depend upon the quantity of gas made; and there are the salaries of meter inspectors, rental clerks, and collectors, cost of bills and receipt-books, which depend upon the number of consumers. We will call the establishment charges A, the manufacturing charges B, and the consumers' expenses C. It is a debatable question whether the establishment charges A should be allocated per consumer or per 1000 cubic feet of gas sold; but there can scarcely be any difference of opinion as to each consumer being charged with an aliquot share of C. If a consumer is to be of any value to the concern, we find that, calling his total annual payment D,

$$D - B > C;$$

and the difference will constitute a contribution to the profit and loss account. If this expression does not hold good, then the customer is a loss, and not a source of profit. The value of C can be readily calculated from any set of accounts. In order to illustrate the point, we will put D as representing 5000 cubic feet at 3s. 6d., B as equivalent to 2s. per 1000 cubic feet, and C as 4s. In this case, D − B = 7s. 6d., leaving a margin of 3s. 6d. to be considered as profit. We also find that—

$$2\tfrac{2}{3}\,(D - B) = C;$$

and it follows that the above expression would become a minus quantity at about 2600 cubic feet. This is exclusive of special expense incurred in the way of meter, stove, or other appliance for the special use of the consumer.

It is immaterial, for the moment, whether the turning point is 2s. or 10s. What I am now seeking to impress is that there is a turning point, or, as Mr. Helps calls it, a paying average, and that any customer whose account does not come up to the point is a source of loss. The question is: What is to be done with the unprofitable customer? No one likes the idea of refusing business, even if the profit is not very apparent. There is a vague impression that the injury incurred by refusing a customer can scarcely be estimated; and so any retail dealer would assure us that he works certain lines at a loss, because by this means he keeps business together. In a similar manner, all gas companies are loaded with a number of small and irregular customers whose business is not worth having; but under the terms of their concessions, they are supposed to supply anybody and everybody, irrespective of the "turning point" or of the paying average.

The best means of meeting this difficulty is the minimum charge, which is simply a *quid pro quo* for the special expenses and liability incurred by the company. One speaker at the Pacific Coast Association meeting above referred to, mentioned that he had put this system into operation, and that there had been absolutely no objection raised by his customers. Perhaps in England some might say at first that it was paying for nothing; but the error in this assertion can easily be proved. Such a procedure appears preferable to the absolute refusal to do business on any terms. It is difficult to show, in view of the liability undertaken by the gas company, that a minimum charge of, say, 20s. per annum is either a hardship or an injustice. The minimum charge has been recognized by Parliament in connection with the supply of electricity; and, in a general way, the prescription of length of service-pipe, and of guaranteeing to use the equivalent of at least 20 per cent. per annum on the cost, which is a feature of the Model Gas Acts, indicates a recognition of the right of the gas company to be preserved from the unprofitable consumer. In our principal towns, where the habits of the artizan classes are very different from those prevailing in rural districts, there appears to be no difficulty in reaching the paying average; but as much cannot be said in respect to small country towns, consisting chiefly of the class known as "residential," or a sort of centre of supply for an agricultural district, with no special manufacturing industry. Mr. Helps shows that the paying average comes in at somewhere about 10,000 cubic feet; and it is by no means certain that this can be obtained by the smaller gas undertakings. They must either adopt a high extra price or a minimum charge, if they wish to be secure from loss. A high extra price is a great injustice to a large slot consumer, and, if the ordinary price of gas is already 3s. 6d. or 4s., is likely to prove a hindrance to business. One essential to a successful slot department is that the gas should be moderately cheap.

While the unprofitable consumer may be got rid of by the drastic remedy of cutting him off, it should be remembered that at the best the company can only recover a portion of their outlay by this means. The meter and the stove may be brought in again, and also the fittings; but there will be a certain wastage of piping, and a considerable portion of the outlay consists of labour. Money paid as wages, when once disbursed, is clean gone; and no portion of it can be recovered. There is also not only the loss on putting in the fittings, &c., but a second expenditure by taking them out. Then there is always a hope that the unprofitable consumer may improve—that having once commenced to use gas, he will from time to time add to the number of burners, put in a gas-fire or other gas appliance, &c. It does not seem unreasonable to hope for an increase in the consumption per consumer. If the first year's working of the slot meter averages 8000 cubic feet per consumer, the second may show 8500 feet, and the third 9000 feet. It would therefore be preferable to guard, as far as possible, in the first place, against getting the unprofitable customer on the books; but when there, the cutting-off process should not be applied until there is absolute certainty that the case is hopeless.

Gas companies are apt to run too much on the lines of the British agriculturist, who, having been accustomed for years to grow corn on a particular plot of land, and finding he cannot sell the produce at what he regards as a remunerative price, sits helplessly down, grumbles about bad trade, and wants his rent and rates reduced. The American farmer does one of two things. If his corn will not sell as corn, he sets to work and extracts whisky, starch, sugar, or other marketable commodity from it; or he drops growing corn that will not yield a profit, and grows potatoes or something else that will. A great deal has been written and said about educating the gas consumer, in the sense of teaching him to avoid wasteful and inefficient appliances; but might not this expression be taken in a wider sense, as inducing the gas consumer to use 2000 cubic feet of gas where he only used 1000 feet before? Surely it is preferable to change the unprofitable consumer, by this sort of education, into a profitable one, than to cut him off. We sometimes hear that a clever shopkeeper will sell people things they do not want, but that any fool can sell them what they do want. This saying is true, not in the sense that the clever salesman induces the customer to buy useless articles, but that he sells some novelty previously unknown to the purchaser, and which affords a good return for the expenditure. Gas companies have kept too closely to the lines of selling "what they do want," and might with advantage study the tactics of the smart counter-hand.

PRACTICAL NOTES ON GAS MANUFACTURE.

By S. Carpenter, of East Ham.

The following notes have not been written for those managers of gas undertakings who have had the advantage of thorough training in all branches of the gas industry, but to assist in a modest way those who have obtained responsible positions in gas-works by virtue of their natural ability, but who have not had the valuable aid of a liberal education. To these, the operations connected with gas manufacture which involve the changes brought about by the force known as chemical action, are frequently shrouded in mystery; and to pierce these clouds slightly the writer has brought together a few notes and facts from his own practical experience, extending over a period of fifty years, and he submits them in the hope that they may be of some service to those who care to peruse them.

Carbonization.

In the manufacture of coal gas the retorts should be of a bright red heat before the coals are put in. Great care should be taken not to have the heat too high. The charge should be moderate in bulk; otherwise, if the retorts are overcharged, as soon as the coal is put in it begins to intumesce, and dense black smoke is produced the moment the lid of the retort is closed. This smoke is nothing more than the volatile constituents of the coal passing off as vapour containing the hydrocarbons and black viscid fluid called tar. As soon as the coal is in the retort, the heat to which it is subjected disturbs the normal position of the material, and a condition is set up resembling the boiling of water in a kettle. If there is too much water in the kettle, it will boil over; and if the retort is overcharged, when the coal begins to intumesce it will fill it, and cause it to scurf. The incrustation thus formed on the interior of the retort not only occupies space which should be available for the coal, but increases the cost of fuel for the furnace and labour in the retort-house. The coke should not be allowed to remain in the retorts too long after all the volatile constituents of the coal have passed off.

Coal gas, as it issues from the retorts, contains the following impurities: Tar, water vapour, ammonia (NH_3), carbonic acid (CO_2), sulphuretted hydrogen (H_2S), and bisulphide of carbon (CS_2). These impurities present themselves in various states of combination. Ammonia is generated during the decomposition of the coal, and it appears in two forms—one being met with in the ammoniacal liquor, and the other in the impure gas. Sulphuretted hydrogen is also found in the liquor and in the gas. Hydrogen presents itself in several ways, and combines with different ingredients, giving rise to various hydrocarbons, such as gas, naphtha, and tar, and with sulphur to form sulphuretted hydrogen. Part unites with nitrogen to produce ammonia, and part with oxygen to form water. The oxygen combines with carbon and carbonic oxide and carbonic acid result; and carbon unites with sulphur and bisulphide of carbon is produced. The constituent elements of coal are carbon, hydrogen, oxygen, nitrogen, sulphur, and iron; and they yield on distillation coke, carburetted hydrogen, hydrogen, various naphthas, carbonic oxide, carbonic acid, ammonia, sulphuretted hydrogen, bisulphuret of carbon, and protosulphuret of iron derived from the decomposition of the bisulphuret. If the mouthpiece of the retort is opened, it will be seen that the excess of carbon remains as coke, which holds the protosulphuret of iron. Part of the hydrogen remains free, while part combines with carbon, giving rise to various kinds of hydrocarbons, such as gas, naphtha, and tar, and also to a little nitrogen, producing basic compounds and hydrocyanic acid. Another part of the hydrogen unites with half the sulphur of the bisulphuret of iron, and with any free sulphur present in the coal, to form sulphuretted hydrogen; while the remainder combines with oxygen to form water, or with nitrogen to produce ammonia—the rest of the oxygen being taken up by part of the carbon, generating carbonic oxide and carbonic acid.

Condensation and Purification.

In considering these subjects, let us first notice the impurities which the gas contains as it leaves the retorts, and follow it as it passes to the condensers and purifiers. By so doing we shall better understand how its impurities, which have been already enumerated, can be removed, and the best material for doing the work. From the hydraulic main the gas passes on to the condensers, the function of which is to cool it, and reduce the vapours intermixed with it into ammoniacal liquor and tar, by which process the latter is prevented from passing forward to the other appliances. A large portion of the watery vapour, as well as some of the tar, is deposited at the bottom of the condensers, from the outlet of which the gas passes on to the exhauster, thence to the scrubbers, and from them to the lime and subsequently to the oxide of iron purifiers.

We will now glance at the work of the different appliances. Taking first the hydraulic main, the writer has found, in practical experience, the wet main to be the best, for several reasons. In the first place, it acts as a water-valve, and prevents the gas from returning down the ascension-pipes when the retorts are

open. Secondly, by having a 2-inch tar seal for the dip-pipes, the gas has to pass through this seal. To a certain extent tar is a purifying agent. At the same time, if its ingredients—the hydrocarbons or similarly constituted substances—did not combine and adhere, the perfect purification of gas would be almost an impossibility. When the gas bubbles through the tar, it loses its smoky colour. There are sulphuretted hydrogen and bisulphide of carbon, as well as other impurities too numerous to mention here, in the combination of hydrocarbon compounds called "tar." The hydraulic main thus acts as a water-valve, and also as a condenser and purifier. Hence we see the necessity for not separating the gas and tar before the condensers are reached, for there they will separate themselves.

Let us consider for a moment the work of the condenser—one of the most essential of the appliances used in the manufacture of gas, serving as it does to reduce the temperature of the gas to the degree most favourable for the deposition of its ammonia in the scrubber. In the writer's opinion, the tar in the condenser eliminates a portion of the sulphuretted hydrogen and bisulphide of carbon, as these impurities are found in the tar. The condenser may, without question, be regarded as part of the purifying plant; for when the gas issues therefrom it has lost its smoky colour, by which we know the purifying process has commenced. The condenser is an apparatus consisting of a double row of pipes about 18 feet high, the size and the number being in accordance with the make of gas per hour. These pipes stand vertically on a cast-iron box, having plates at each end bolted to flanges, so that they may be taken off at any time for cleaning. This is the simplest, and at the same time one of the best, forms of apparatus for slow condensation. Great care should be taken in cooling the gas before it enters the condensers. Do not cool it too suddenly, or convey it from the retorts in pipes in direct contact with atmospheric air; but, if possible, take it just under the floor of the retort-house. While excessive condensation has its disadvantages, insufficient condensation has also its evils. If the gas is gradually cooled, and the tar kept in contact with it until it has passed through the condensers, the writer is of opinion that there will be little or no trouble with naphthalene in the mains, whether before or after the gas has undergone the process of purification.

From the outlet of the condenser the gas passes on to the exhauster, and thence to the scrubbers. The work of these vessels is to remove the ammonia from the gas. The writer prefers what are known as "tower" scrubbers, for the reason that the gas enters at the bottom, and in passing through the scrubber is met by water falling from the top like rain. The stream of gas, in ascending, is divided up, so to speak, by a series of intervening wood grids or broken bricks, so as to present it in a finely-divided state to the descending water. If the temperature of the gas entering the scrubber is about 70° Fahr., and that of the fresh water 60°, the water is capable of absorbing about 780 times its volume of ammonia, fully 2½ volumes of sulphuretted hydrogen, and one volume of carbonic acid. The writer is speaking from practical experience with "tower" scrubbers, in which fresh water and then ammoniacal liquor were used.

The next step in the purification of coal gas is its treatment by passing it through vessels charged with dry lime. Two of these purifiers will be sufficient for the removal of all the carbonic acid and part of the bisulphide of carbon in the gas; but, of course, their size will vary according to the make of gas. The work of the first lime purifier is to decarbonate the gas, and at the same time remove part of the bisulphide of carbon and sulphuretted hydrogen. The gas which has been decarbonated in the first purifier is passed into the second, where more of the bisulphide will be removed. The gas is afterwards turned into vessels charged with oxide of iron, to take out the sulphuretted hydrogen remaining in it after the lime purification. If the gas is treated in the manner described, it will be purified in the way considered best at the present time.

A few remarks may now be offered on the working of lime purifiers. As already stated, it will be sufficient to have two in action at the same time. It is not so much the depth of lime as surface of material that is required for the removal of the impurities from the crude gas; and it is much more advantageous to have a large surface of lime in thin layers than a small one in thick layers. By "thick" layers, the writer means those from 7 to 9 or 10 inches; by "thin" layers, those from 4 to 4½ inches. His reason for preferring thin layers is that when the gas is first turned into the purifier it enters with considerable velocity; and if the lime is very thick, it offers great resistance. If there should happen to be a weak place in the layer, the gas would pass through it much more quickly than the other part; but if the lime is thin, it offers less obstruction to the progress of the gas. With four layers of lime, there are, of course, four surfaces for the gas to act upon.

When the crude gas is first admitted into the lime purifier, the valve should be opened very slowly, so as not to disturb the normal position of the material. Lime has a much greater affinity for carbonic acid than for sulphuretted hydrogen, and it is very active in taking out the former impurity. After the gas has gone through the lime in the first purifier, all the carbonic acid and part of the bisulphide of carbon have been taken out, as well as a portion of the sulphuretted hydrogen. The rest of the latter impurity passes on to the second purifier, and converts the lime into hydrogenated sulphide of calcium, which will remove another portion of the bisulphide of carbon. The writer's advice is never to have thick layers of lime if it can possibly be prevented, as the impurities get very much intermixed with the material. When the crude gas first comes in contact with the lime, if there are four layers, most of the impurities will be deposited in the first two. The carbonic acid will be taken out by the first, and the second will remove another portion; while material in the third and fourth becomes for a time hydrogenated sulphide of calcium, which has great affinity for bisulphide of carbon. The decarbonated gas which passes into the second purifier will convert the lime therein into hydrogenated sulphide of calcium, which will take out another portion of the bisulphide.

No atmospheric air should be allowed to pass into the lime purifiers, as it would interfere with the efficacy of the lime for the removal of the bisulphide of carbon. If air is used at all, it should be passed in with the gas at the inlet of the first oxide of iron purifier, which is the only place where it can be employed without interfering with the process of purification. From 1½ to 2 per cent. of air may be admitted, which will be sufficient to keep the oxide in an active condition. As the result of practical experience, the writer has found that when sulphuretted hydrogen makes its appearance on the top of the first oxide purifier, it is a good thing to pass in a small quantity of air at the inlet of the second. If air is used in the way described, the oxide will last in the purifiers for months instead of weeks.

(To be continued.)

THE INTERNATIONAL GAS CONGRESS.

WET AND DRY METERS.

By P. BIGEARD, of Angers.

[A Paper read before the International Gas Congress at Paris.]

Gas companies now number among their customers so many workpeople and others who are frequently absent from their homes that it is almost impossible to undertake the regular inspection and watering of the wet meters used by this class of consumers. Besides, the inconveniences attendant on the use of these meters, and the difficulties experienced in finding a suitable place for them in every case, are strong arguments in favour of the employment of dry meters.

I have no intention of making any special claims for dry meters; I only wish to raise criticism of the two methods. Discussion of their relative merits is not new, for it has occupied the minds of gas companies ever since 1855; and in 1891 it was debated by the Eastern Counties (England) Association of Gas Managers.

In 1871, the Paris Gas Company were the subject of a petition to the Préfet de la Seine, who decided that "in future no dry meters should be placed in the houses of gas consumers." I may add also that in 1875, I was called upon to discontinue the use of this type of meter, of which the gas-works which I was then controlling was making extensive use. But since that time the question has assumed another aspect. The "Transactions" of the Société Technique de l'Industrie du Gaz en France from 1874 to 1898 show that forty papers on the measurement of gas were presented. Almost all these relate to wet meters, and to the many improvements it has been found necessary to introduce. Most of these improvements aim at an exact maintenance of the water level and accurate measurement.

If the Clegg meter (improved by Malam and Crosley) is still preferred by the large companies, and is the only one recognized by the City of Paris, it may likewise be remarked that meters of the same type—with differences according to local necessities—are in use in other large towns in France in which means of verifying the readings exist. The Siry-Lizars drum-meter has also met with many supporters in provincial works.

At the same time that efforts were being made to improve the wet meter of Clegg, similar endeavours were being made to perfect the dry meter. In the course of my work at Angers, I have arranged a special section of the distributing system, which is supplied by two meters which successively register the gas consumption. The wet meter is a 10-light unvarying water-line meter, the level of which is regularly checked. A dry meter of the same capacity is connected to it. The consumption has been read at different intervals; and after six months' observations we find that the two meters registered 728 and 733 cubic metres respectively. The table (next page) gives details of the readings.

The inconveniences occasioned by the cold weather of last winter at Angers must be mentioned. Many consumers had their gas supply cut off for periods varying from twenty-four hours to eight or ten days. Some, indeed, on the boundary of our district, could not get any gas during the whole of the cold season. In consequence of the number of meters put out of action by the frost as well other climatic conditions—such as snow, frost, &c.—we were compelled on some days to confine our attention to business consumers, and to neglect the purely domestic supplies. From carefully prepared reports, we found that, out of a total of 4500 meters, 250 were put out of order by

On Nov. 25, the Wet (Siry-Lizars) Meter stood at 47.			On Nov. 25, the Dry Meter stood at 0.		
Date.	Reading.	Consumption	Date.	Reading.	Consumption.
Nov. 25 . . .	47	..	Nov. 25 . .	0	..
Nov. 30 . . .	64	17	Nov. 30 . .	17	17
Dec. 31 . . .	190	126	Dec. 31. . .	143	126
Jan. 31 . . .	368	178	Jan. 31 . . .	322	179
Feb. 28 . . .	503	135	Feb. 28. . .	457	135
Mar. 31 . . .	603	100	Mar. 31 . .	557	100
Ap. 23 . . .	667	64	Ap. 23 . . .	622	65
May 23 . . .	775	108	May 23 . . .	739	111
Total		728	Total . . .		733
Reduction of pressure by the meter, 2 to 3 mm.			Reduction of pressure by the meter, 2, 3, and 4 mm. (4 mm. under inlet pressure of 23 mm., and consumption of 900 litres per hour).		

the frost alone (the temperature remained 10° or 12° C. below zero for about a fortnight). We found also that the meters which were put in order after the first stoppage were frequently blocked up with ice, although they had been carefully thawed, supplied with a solution of calcium chloride of 15° Baumé, and otherwise protected.

If, to this annoyance of the total disorganization of the supply, we add the damage to the interior mechanism of the meters, the necessity of cleaning out the meters which were supplied with non-freezing liquid at the end of the winter, and the expense and waste of time entailed in these operations, it will be agreed, I am sure, that the evils of wet meters are by no means inconsiderable, and demand serious attention by the gas profession.

Of course, gas-meters should be placed in positions as little exposed to frost as possible, and consumers ought to assist in this. But unsuitable places and indifferent consumers have to be reckoned with. Whatever may be the good qualities of the wet meter, it is safe to say that its action is not always exact, and that the supplier of gas is always the party who suffers from its stoppages and irregularities.

There are few examples of meters which work to the disadvantage of the consumer. The permissible limit of 1 per cent., allowed for 5-light meters and above, is never exceeded to the advantage of the gas-maker. In the course of thirty years, I have come across scarcely any cases in which the consumer suffered.

In 1898, I undertook the testing of all the meters (of 5 lights and upwards) which had been in use at the Angers works for ten years. They were checked by a gasholder and experimental meter. The results on 2049 meters were as follows:—

In good condition	1847
Measurement below real amount (4 to 15 per cent.) . .	175
Measurement below real amount (more than 15 per cent.)	27

167 were replaced.

Without naming the causes which bring about the lowering of the water-level in meters, it is worth while recalling the principal reasons for the improper action of these instruments. The employees do the levelling with insufficient care; most frequently they do not go to the trouble of opening a burner on the mains in order to allow the level to be correctly obtained. Further, after some years' use, the rod of the float becomes oxidized, and frequently sticks on its guide.* Perforations in the wheel, and the latter getting off its axis, are the chief causes of cessation of action. The syphon tubes also give rise to frequent stoppages; while an intermittent supply is caused by too low a level.

It will be objected that careful inspection removes all the difficulties which have been brought forward—an argument with which I agree, though I believe none the less that many cases of imperfect action are inherent in the wet meters. Even supposing inspection is to solve these difficulties, regular visits of an inspector, say, every fortnight, are not likely to be met with favour by the company's *clientèle*.

Many Swiss managers use none but dry meters. In Germany, also, they form perhaps 90 per cent. of a town's supply. These managers are no doubt guided by certain reasons which it would be interesting to know.

Whatever may be the criticisms to which a discussion of this subject will give rise, our place as servants of the public as well as of the gas companies, and the fact that the official registration is a guarantee of the meter, lead me to propose—(1) The re-admission of dry meters to official registration. (2) The establishment of a gas-meter testing-station.

The following questions on the subject might be put: What inconveniences occur in connection with—

1.—The bellows after some use.
2.—The slide-valve.
3.—The jointed rods.
4.—Naphthalene.
5.—Cleaning.
6.—Heat and cold.
7.—Condensation in the meter.
8.—What is the average diminution of pressure with 5, 10, and 20 light meters?
9.—Are larger than 20-light meters commonly used?
10.—What is the average life of a dry meter in constant use (*a*) when new, and (*b*) after repair?
11.—After what (approximate) period do difficulties commence to arise?

* I have had an example of this during the present year. A large consumer was suddenly deprived of light. The valve-rod being left hung from one of the points caused by the oxidation of the metal, the evening pressure, or the opening of a neighbouring meter of 300 lights, had caused the valve in its fall to cut off the gas, though the level had been checked the previous evening

THE BOULE LIGHT.

By Ernest Salzenberg, of Crefeld.

[A Paper read before the International Gas Congress at Paris.]

Since Dr. Auer von Welsbach placed the third model of his burner upon the market (in October, 1891), and obtained the efficiency of 2 litres of gas consumed per candle power, the general tendency of those engaged on this question has been in the direction of still further obtaining the heat energy in the form of light. Two methods have been followed. According to the first of these methods, special burners are provided, in which a higher efficiency is obtained by a more perfect admixture of the gases. I may mention the first Denayrouze burner (July, 1895), which works with a rapidly rotating fan. Lewes obtained with this, it would appear, 250-candle power with 252 litres; and, in another burner, 1-candle power per 1·5 litres.

In the burner of O. Kern, made in the same year, with a pressure of from 45 to 300 mm. one could obtain 1-candle power with a consumption of 1·4 litres of gas or even with less at a pressure of 400 mm. But this burner has never been introduced into Germany. In the St. Paul burner, the gas is superheated, and gives under pressures of 70, 152, and 200 mm. and gas consumptions of 350, 500, and 570 litres, respectively 265, 400, and 645 candle power—*i.e.*, 1·32, 1·25, and 0·8 litres per candle. To detail others would take up too much space.

The second method sought to give the increased yield by raising the pressure of the gas, and also of the air. The connection between increased pressure and greater luminosity has already been dwelt upon. In the year 1892, Fahndrich, of Vienna, stated, in reference to the use of compressed Pintsch gas at Strasburg, that high pressure meant a great amount of light; and he predicted that the Welsbach burner would, in course of time, attain from 300 to 500 candle power. In the same year, Herr von Oechelhaeuser stated, in his report to the Industrial Association at Berlin, that every millimetre of pressure over and above the normal corresponded to an increase of about 1-candle power.

According to Fahndrich, there are only these two processes, but twelve arrangements of apparatus for increasing the light by means of increased pressure of the combustible gas, and four for achieving the same end by increasing the pressure of the air. The briefest mention of these will call to mind the technical history of the processes.

Pintsch Process.—German patent No. 61,314; annulled in 1896. Gas burnt under a pressure of 1·5 to 2 metres of water. Air at normal pressure.

George Rothgiesser claimed hydraulic compression of the gas in three patents of 1897 and 1898.

Inderau and Co., of Dresden (1896-7).—The patents simply claim the production of extra pressure by pumping the gas.

Haussmann-Dortmand.—Three patents (1897) claiming the use of a hydraulic motor.

Adolph Rudolph, Stuttgart (1899).—Compression by means of an air-pump worked by a weight.

A. Lecomte and J. Loeser, of Paris.—German patent (1898) for compression by means of a kind of meter used as an exhauster.

Intensified Gas Syndicate, of London.—A pressure of 230 mm. is used.

James Keith.—Automatic apparatus for simultaneously compressing gas and air.

A. Ivan Vriesland, of Amsterdam.—Compression by means of a kind of archimedean screw.

Wenzel Knapp and Richard Steilberg, of Hamburg.—Two reservoirs placed one above the other, for the compression of the gas by the different heights of the columns of water.

C. S. Snell, of Saltash.—Compression by means of the heat produced.

William Sugg.—Patented compressor and regulator. One litre per candle power.

Yorkshire Intensified Gas Lighting Syndicate and the *Société Anonyme d'Eclairage et de Chauffage Intensifs, of Brussels*, have likewise brought out installations.

Lumière Boule, or Kugellicht, is protected under the German patent No. 107,935, of December, 1899. Other different models were patented in the autumn of 1899 and the spring of 1900, for a noiseless high-pressure burner for supporting incandescent mantles. The Kugellicht Gesellschaft, of Dresden, by whom my appliances are made and handled, are about to obtain other patent rights for various burners. The principal patent claims simply a process, and especially the use of a pressure of one atmosphere.

To render complete this part of my paper, I may mention the

four different systems of incandescent lighting with compressed air, which have come under my notice. The oldest (September, 1891) is that of Hugel, who used carburetted air in rubber chambers under a weight. This was followed by the system of August Nagel, in which, however, the incandescent mantle soon deteriorated. The burner of Schülke, Brandholt, and Co., based on Oehlmann's patents, claimed to use only 0·8 litre per candle power. Lastly, the patents of Ferron, of Paris, provide a conical chamber for the mixing of the gases, and an injector for the compressed air. These methods are all dependent on certain details of construction; and, according to the German Patent Office, they cannot be called processes, with the exceptions only of those of Pintsch and Salzenberg (patent No. 107,935).

This latter claims: (1) Great luminosity. (2) High efficiency. (3) Yellowish white light. (4) Uniform distribution of the light in the horizontal plane. Hence the name "Kugellicht," or "Lumière Boule." (5) Compression of the gas to one atmosphere and upwards. The intensity of the light varies between 300 and 1200 candle power; the efficiency reaches 0·85 litre, and even 0·8 litre per candle power. An intensity of 1800 candles can be produced in a single burner.

Dr. Bunte finds that the most suitable pressure for my first and very primitive burner is 1·1 atmospheres, corresponding to 1 litre per candle power. But a glance over the figures will show that increase in the pressure and in the gas consumed in the unit of time corresponds to a decrease in the gas per candle power. The gas can be compressed quite well to 10 atmospheres in a metal reservoir, although for practical purposes the increased motive power required limits the compression to about 3·5 atmospheres. The actual pressure of combustion must not fall below 1·1 atmospheres.

It may be mentioned that, according to Botley, only 16 8 per cent. of lighting power is lost in burning gas compressed to 14 atmospheres in a butterfly burner, and less, of course, in a bunsen burner. I need not stay to comment on the cheapness of illumination requiring 0·8 to 0·9 litre per candle power—*i.e.*, giving 1000-candle power with 800 to 900 litres of gas, according to comparative measurements made by Herr von Oechelhaeuser and others.

A "Globe" light consuming 850 litres of gas, at 16 pf. (say, 1¾d.) per cubic metre, works out to 13·6 pf. per 1000-candle power per hour, and still less with gas at 15 pf. per cubic metre. Expenses for motive power must be added. Sixteen "Globe" lights of 1000-candle power require 1-horse power per hour. If the consumption of the gas for this purpose be placed at 720 litres per horse-power-hour, it will be seen that the total energy absorbed comes to 850 + 45, or 900 litres for 1000 candle-power-hours. The hourly cost can thus be compared with an electric arc lamp of 100 carcels. In these calculations, the two items of consumption of mantles and of carbons are not included, nor are the amounts of interest and depreciation, which are usually higher in central electric light stations—to an extent that a kilowatt-hour could be obtained with a force equal to the cost of 900 litres of gas only under very exceptional conditions.

The mixture of air and gas in my burner contains 86 per cent. air and 14 per cent. gas, when the admission of the air is being properly made. The following figures will show how much more uniformly the light is distributed by the "Globe" burner than by the Welsbach burner. The intensity of the light given by the burner exceeds that of the Welsbach, at angles below the horizontal, as follows:—

	Per Cent.
30°	4 6
40°	10·7
50°	14·6
60°	13·8
70°	14 2

The colour of the light is more similar to sunlight than the bluish colour of the electric arc or the greenish tint of the Welsbach burner. The uniform distribution gives a wonderful absence of shadow compared with that observable in the case of an arc lamp, insomuch that a friend of mine—a Professor in the High School at Charlottenburg—has wittily named my light "la lumière de Pierre Schlmeil" or "the man without a shadow," after one of the well-known stories of the French poet, Adalbert de Chamisso.

There is, of course, divided opinion as to which is the best colour for a light. Some prefer white light in (say) shops, &c.; but the general preference is for a yellowish light, especially since it has been shown by Professor Hempel that white light exerts a stronger chemical action on the purple of the retina, and is therefore more fatiguing to the eyes. Dr. Bunte, who has made a number of photometric and spectro-photometric tests of this and other incandescent lights, concludes as follows: (1) Compression to 1·1 atmospheres is very economical in gas. (2) The distribution of the light at this pressure is much more uniform than in ordinary incandescent systems. (3) The light is of an agreeable yellowish colour, resembling sunlight, and the efficiency of the burners is very high.

A small installation (for a works supplying a town of, say, 100,000 inhabitants) to serve, say, 200 1000-candle power lamps, will consist of a plant as follows: A gas-motor, with meter for adjusting the gas to the motive power required; a compressor to deal with a maximum of 240 cubic metres per hour, and to deliver into the reservoir at 3·5 atmospheres; a station meter of 225 cubic metres per hour; an arrangement of valves between the station meter and the compressor; a reservoir of compressed gas, of a capacity of 60 cubic metres; a principal main (400 mm.); a wrought-iron main (75 mm.) for the compressed gas; valves, safety valves, cocks, &c.

The gas is drawn from the works' holder or the mains, compressed, and passed to the reservoir through a non-return valve. The outlet from the reservoir is by way of a reducing valve. The principal main has an internal diameter of 76 mm.—thus involving a loss of 0·45 atmosphere in a length of twice the 3000 metres which supply the town. The pressure of the gas, therefore, on its delivery should be 1·45 atmospheres if it is to be still equivalent to 1 atmosphere at the most distant point. A smaller installation for 30 lamps of 1000-candle power is similarly arranged. The diameter of the inner tube of gas is 40 mm., and the maximum loss 0·23 atmosphere. A still smaller plant, for 10 lamps of 1000-candle power—such as is suitable for warehouses, hotels, &c., can have the compressor fixed in the cellar, and the other plant arranged as above.

There is nothing new in the employment of high-pressure mains of small dimensions, which is such an inexpensive arrangement. I may, however, direct attention to the fact that at Phœnixville and Royersford (North America) there are distributing systems of compressed gas to all consumers, the diameter of which is 76 mm. in a length of 7 kilometres. The pressure in these American towns is one atmosphere, and is obtained by means of a gas-engine of about 20-horse power. Where consumers do not require such a high pressure, it is easy to place a reducing valve in front of the meter. The loss of pressure is calculated from the tables given by Riedler and Gutermuth in their paper on the compressed-air plants of Paris—allowance being made for the difference between air and coal gas. This diminution of pressure can be kept very small if the system is carefully laid down, and the junctions are electrically soldered. Another important factor is the arrangement of the installation so that the main is under the pressure required by the bye-pass light. At other times, the gas is at the pressure under which lamps are usually burnt at night. A three-way cock provides a ready means of doing this.

The condensation products which collect in the reservoir in which the compressed gas is stored, should be tapped off every day, or every second day, by a blow-off cock. If the reservoir goes for long without emptying, these products (which are milky in appearance) may contain as much as 4 per cent. of benzene. The principal main is likewise provided with plugs at its lowest points, or better still with trapped boxes, for the removal of the liquid. The small quantity of naphthalene which is condensed can be removed by these plugs. A chamber containing chloride of calcium may be placed between the gas-reservoir and the reducing valve, so as to remove the last traces of moisture, and ensure freedom from any danger of water freezing in the distribution system.

There are two types of burners: (1) The "Universal" burner provides an annular outlet for the gas, and is applicable to illuminating powers of 300 to 1800 candle power. A conical chamber in it causes the gas to assume a whirling motion around a conical regulating needle, with the result that it mixes very perfectly with the air drawn into the burner. (2) The "Standard" burner is similar to the ordinary Welsbach burner, and is more specially used for 600 to 800 candle power work. The quantity of gas passed is determined by two small orifices at the foot of the burner.

No chimney is used on the burners, which are provided with a simple arrangement for regulating the air supply by means of moveable cylinder. Both burn extremely quietly. The "Standard" makes slightly less noise than the "Universal," and is therefore better adapted for halls and other interiors; while the other is most applicable to open-air premises, goods yards, &c. The lamps are suspended in a similar manner to electric arc lamps.

The pipes communicating directly with the burners and supplying the supplementary light kept going at night are protected by india-rubber of the special brand known as "Durite," which is proof against wear and tear.

The mantles are of the thorium-cerite type, and are woven of single or double fabric. In the latter case, they are, of course, much stronger. The height of the illuminating area is 12 centimetres. The mantles are burnt-off by means of a bunsen burner at ordinary pressure. Their life is about 100 to 150 hours in outside installations, or 350 hours or more indoors, with the small extra flash light.

The weight of the mantle when in use is about seven times that of the ordinary mantles—*i.e.*, about 3·8 grammes. It is suspended by means of two supports, which can be moved in the vertical plane.

In order to prevent an excessive spreading of the mantles in the flame, asbestos threads are used to hold them in place after the manner of a balloon in course of inflation.

The use of collodionized mantles is not recommended for the "Globe" light any more than for Welsbach burners, on account of the decrease in the illuminating power. The best shape that the mantle can have, to hold the incandescent body completely in the cone of flame, is that of a sack of corn.

Transparent globes on the burners absorb about 6 per cent. of the light; opal globes, from 20 to 31 per cent. In the case of frosted globes, the absorption varies with the position of the centre of the globe in relation to the axis of the photometer.

The heating effect of the lamp has not been exaggerated.

According to my experience it is about 23 times that of 16-candle power incandescent electric lamps, with perhaps rather more when combustion is more rapid. If we reckon the heat radiated from a 16-candle power electric incandescent lamp as 1, the heat from a 16-candle power butterfly burner is about 20, and that from an ordinary incandescent gas-burner of 60-candle power burning 2 litres per candle power is 3·5. Hence the relative amounts of heat radiated by gas and electric incandescent illuminants producing 16-candle power are 0·9 and 1. Assuming a consumption of 1 litre per candle power in the "Globe" light ("Lumière Boule"), the heat radiated by this latter is equal to $\frac{3{\cdot}5 \times 1000}{60} \times \frac{1}{2} = 29$, or equal to 35 times that of an electric incandescent lamp—allowance being made for the increased heat from rapid combustion. It may, however, be said that the glass shade of the "Globe" lamp can easily be held between the hands. It can be used in an inclined position, without appreciable diminution of light, even up to an angle of 20° from the vertical.

The advantages of the "Lumière Boule" from the hygienic point of view are exactly comparable with those of the Welsbach. Neglecting the very slightly more favourable proportion of gas and air in the "Globe" light compared with that in the Welsbach (which produces, according to Gréhant, only three-ten-thousandths per cent. of carbonic oxide) a "Lumière Boule" of 1000-candle power and 850 litres gas consumption gives—

$$0{\cdot}0003 \times \frac{850}{120} = 0{\cdot}0021$$

i.e., two-thousandths per cent. of carbonic oxide. The maximum proportion permissible, according to Professor Vivian B. Lewes, is two-hundredths per cent.

The "Universal" lamps produce, as already stated, a certain noise, which is different from the "fizzing" of the electric arc. The precautions to be observed in the construction of the burners, that this noise may be reduced to a minimum, were set forth by Dr. Meipinger in 1891. They are: (1) The right proportion of gas and air. (2) Speed of the issuing gas. (3) Relative dimensions of the transverse section and the length of mixing-tube. Welsbach burners gave rise to a disagreeable noise in their early days; and similar causes may be responsible for the phenomenon in the case of the "Lumière Boule." It can be avoided to a large extent by placing the burner about one-third above or below the centre of the globe—not exactly at the centre.

In conclusion, this system is applicable to water gas and carburetted gas as well as to coal gas.

The Commission of engineers appointed by the Berlin War Department made an important series of tests of the "Lumière Boule" (used in conjunction with reflectors) alongside electrical projection lights. The tests took place in the Crefeld Gas-Works, in the presence of many military officials. A series of electrical projectors from the fortifications of Cologne were used; and the results showed that for certain search-light purposes the electrical illuminant was specially suitable, on account of the small dimensions of the luminous beam, while in lighting more extensive regions around fortresses, as well as for open sheds, &c., the "Lumière Boule" was specially suitable—its beam being about 15 times larger.

It has been found that a "Globe" projector of 6000-candle power, at a distance of 3 kilometres, and with a size of beam of 400 metres in breadth, was amply sufficient for the carrying out of earth works of all kinds. The men in the field of illumination cast long dense shadows, and a piece of paper held at a short distance from the face received a silhouette of the features, and at this distance of 3 kilometres large print could be easily read. I have worked out graphically—from some photometric tests with incandescent lights (with compressed air) using 30, 40, 50, 60, and 70 mm. pressure of gas and 0·3, 0·4, and 0·5 atmospheres pressure of air—that the efficiency of lamps with an air pressure of 0·3 atmosphere is scarcely better than with ordinary Welsbach burners; and the use of compressed air in this manner possesses the disadvantage (essential in connection with the "Lumière Boule") that the supplies of air during combustion cannot be correctly proportioned. But this correct proportioning is essential if the best result is to be obtained. Illumination by means of compressed air is also dependent on two variable factors—normal pressure of the gas, which is uncertain, and the pressure of the air, which is again open to uncertainty. The "Globe" light is affected by only one variable factor—the increased pressure of the gas; and as atmospheric pressure is in general constant, the relations between the combustible and the supporter of combustion can be most exactly regulated.

Electricity for the Supply of Light and Power at the Paris Exhibition.—The Secretary of the British Iron Trade Association has reported upon the display of iron and steel at the Paris Exhibition; and in the course thereof he has furnished some interesting figures in regard to the electrical exhibits under each of the different sections. They show that the electric lighting exhibits sent by the various countries number as follows: Austria, 3; Belgium, 1; France, 97; Germany, 15; Great Britain, 13; Hungary, 5; Italy, 3; Sweden, 2; Switzerland, 7; United States, 75. The numbers of exhibits furnishing electric power are as follows: Austria, 10; France, 82; Germany, 17; Great Britain, 19; Hungary, 9; Italy, 14; Sweden, 5; Switzerland, 13; United States, 102.

METHODS FOR GIVING STOKERS AN INTEREST IN THEIR WORK.

By I. Hedde, of Paris.

[A Paper read before the International Gas Congress in Paris.]

The object of the present paper is to analyze the question which figures in the programme proposed by the Organizing Committee of the Congress under the following title: "Description of the Systems Employed to interest Stokers in the Yield of Gas and Economy in Stoking."

Long ago, in 1877, the importance of this question was emphasized by the Société Technique du Gaz en France, when to its great honour it instituted prizes for foremen and workmen who had been the longest, and rendered the greatest services, in the same gas-works, and later, with the same idea, the Société obtained medals of honour from the Government to award to its most deserving and most faithful servants. With this object in view, I applied to my colleagues of the Société Technique, and a certain number of managers of companies and directors of works—members of the Association—kindly supplied particulars of the means employed for this purpose in their works.

The subject has been divided into three parts: 1. A description of the "technical means" for giving stokers an interest in their work, consisting of premiums on manufacture granted on the yield of gas and for economy of fuel. To avoid repetition and too great length, I shall merely give one of the replies received, taken from among those which detail the same methods. 2. General methods for making stokers take an interest in the style of their work and the prosperity of the undertaking. 3. Discussion of these methods and proposed solution. I shall, at once, add that this study does not pretend to give a solution applicable in all cases. Any such solution cannot exist, because it varies with the particular circumstances of each works. The object I have in view is merely to give an account of the means employed and the general principles of their application.

I. Technical Means for Giving Stokers an Interest in Their Work.

1. Wages of stokers. The work can be remunerated as follows: A. Fixed wages. B. A premium on manufacture, given for assiduity or good workmanship. C. The salary reserved for provident institution, for assistance in sickness, and for pensions.

A.—*Fixed Wages.*

The fixed wages are usually paid by the month in small works, by the day in average-sized works, and by the piece in large works. It would be better to pay fixed wages as frequently as possible—once a week, for example—because they are to meet the current needs of life. But this mode of payment has the inconvenience of augmenting the work of the wages account, and always settling with the workmen on the same day (Monday or Saturday), which may make them contract the habit of squandering their money on pay day. Payment every fortnight is most advisable and most common—on the 1st and 16th of the month. A month is too long, because the workman requires money on account or else buys on credit, and thus incurs debt.

It is generally admitted to be advantageous to defer payment of a part of the fixed wages or the premiums on manufacture for variable periods of time, according to the customs of the locality, so as to enable the workmen to meet payments at fixed dates—like rent, taxes, purchase of clothes, &c. The deferred amount is generally applied in payment of premiums on manufacture per quarter, half year, or year.

B.—*Premiums on Manufacture.*

The premium on manufacture is an increase of wages given to foremen, furnace superintendents, and stokers, either to stimulate their zeal to produce more gas, in conditions determined by the regulations, or compensate them for their extra labour and attention, or the regularity and assiduity of their attendance. Its contrary is the fine—penalty for bad work—the amount of which is kept back from the workman's wages, and is usually paid into the sick or pension fund, where there is such an institution.

Premiums on manufacture may be individual or general, according as they apply to each workman or to all the stokers among whom they are divided.

I give below the replies received from some colleagues regarding the various types of premiums paid—indicating the works by letters, as most of them were given in confidence.

Works A.—In order to make the stokers take an interest in their work, I award them a gratuity of 5 frs. per month; and when the work is defective I deduct 1 fr. or 2 frs., or more, according to the extent of the defects.

Works B.—The daily wages of the stokers are made up of: 1. A fixed sum of 4 frs. 2. A labour premium of 0·50 fr. 3. An attendance premium of 5 frs. per fortnight, which is only payable when the workman has been present during all that time. Finally, a daily premium of 0·50 fr. is also given to the head stoker of each gang. The labour premium was given before my arrival, when the output attained 200 cubic metres per retort per 24 hours. As this amount has for some years always been attained, I gave up this condition of manufacture. The premium

is now left entirely in the hands of the manager, who can withhold it when he considers that the workmen have not done what they ought. Thus in one fortnight, in spite of an average manufacture of 240 cubic metres per retort, the premiums were discontinued for five days, and also two stokers had to pay an additional fine of 1 fr. and forfeit their right to their allowance of coke for six months, owing to their bad work. This will make you understand that the stokers only work by fines, and that the manufacture of gas is the last thing they think about.

Works C.—Our stokers first receive fixed wages, variable with their rank, their period of service, &c. In the second place, they have 0·50 fr. per day as an "assiduity premium." This premium is paid twice a year, in May and September. When a stoker leaves the works for any reason, the premium is taken into account. Finally, the fixed daily wages apply to a quantity of 4000 kilos. of coal carbonized per setting in 24 hours. The stokers receive 0·15 fr. per 100 kilos. of coal carbonized in addition to the 4000 kilos.; but the weight of the coal to be retorted is fixed by the foreman, who writes it down every day on the board opposite the scale. When the furnaces are not hot, the weight of coal to be carbonized is reduced, and augmented when the heat of the furnaces permits. Consequently, the stokers are indirectly interested in the good working of the furnace.

Works D.—The stokers wages are: 1. Fixed daily wages of 3·75 frs. 2. An extra payment of 0·25 fr. per day paid at the end of 90 days' work. 3. A premium on the coal carbonized of 0·125 fr. per 100 kilos. increase in the weight of the charge, for the six-hour charge, starting from 1000 kilos. for the direct-fired furnaces, and 1200 kilos. for the regenerative furnaces. When the charge is badly burnt off, the stoker is fined 0·25 fr.

Works E.—The premium based upon the amount of coal carbonized had long been practised here. It was very inconvenient to me, because it increased the pay in proportion to the bad working of the furnaces. It was to the stokers' interest to put the greatest possible amount of coal into the retorts without considering the yield of gas. I have instituted a premium based upon the yield of 300 cubic metres as the normal yield of a ton of English coal; and we grant a premium of 0·50 fr. per 300 cubic metres of gas, which is divided among all the stokers and firemen, including the engine and exhauster man, according to the number of hours each man has worked. This premium is fixed every month, and is paid on June 20 and Dec. 20—that is to say, the time when rents are paid (the Feast of St. John and Christmas). It represents 0·85 fr. to 1 fr. per day, according to the number of the stokers or the retorts fired.

Works F.—The stokers receive fixed wages of 4·15 frs. per day, and 4·65 frs. per night, and also a gratuity of 15 frs. per month—viz., 0·50 fr. per day. This system will be replaced by the following: 1. Fixed wages of 4 frs. per day and 4·50 frs. per night. 2. A premium of 1 fr. per 1000 cubic metres of gas manufactured, to be divided among all the stokers. 3. A daily "attendance premium" of 0·05 fr. per day for the first 200 days, 0·10 fr. for the next 100 days, and 0·25 fr. for the last 65 days of the year. This "assiduity premium" will be paid on Jan. 1. The system of payment deals with: 1. The greater expenses of the workmen engaged in night work. 2. The yield of the setting (there is one stoker per setting), and consequently indirectly with the cost of firing. These expenses decrease in a general way with the increase of the production per setting. 3. The assiduity of stokers, by increasing their wages when they do not leave the works in summer. 4. Calculation of this system of payment is simple enough to allow the foreman to make out the wages bill without great loss of time. 5. Retaining of the daily gratuity, which is only paid at the end of the year, encourages the men to remain at the works or to enter them in the autumn when they are to be discharged in summer.

Works G.—The wages of the stokers are 3·30 frs. per diem, and 3 frs. for their assistants. In addition to this fixed rate of pay, they receive a premium of 4 frs. per 1000 cubic metres on the amount of gas produced by the retort-setting in excess of 1000 cubic metres per 24 hours. That is to say, if a furnace gives 1500 cubic metres, the two stokers (the one working at night and the other during the day) receive 1 fr. each. This system gives the men better wages when, to meet the needs of consumption, we wish them to carbonize a greater amount of coal.

Works H.—For two years, a premium on manufacture has been paid of 2 frs. per fortnight for every 50 cubic metres of gas daily produced by a setting over 1500 cubic metres. The annual average yield thus obtained amounted to 291 cubic metres per ton, the daily production varying from 1700 to 1800 cubic metres per setting. The consumption of coke is 24 hectolitres per setting—viz., about 4 hectolitres per ton. This supplementary premium gives the stokers from 8 to 12 frs. per fortnight. The charges must be well worked off; and, as no fines are inflicted when a stoker allows his charges to fire, he is suspended for some days, and dismissed for a second offence of this kind. There is no premium for exercising economy in the use of coke for firing, which should be the result of active supervision and continual maintenance of the fires.

Works K.—Works in which the employees have an interest give the best results. When the workman has no direct or immediate interest, he will not take the trouble to place in the retort, by an intelligent system of charging, the maximum utilizable amount of coal, nor will he give that rapidity of charging which is one of the elements of a good yield, nor attend to the furnace with so much care. There are two cases to consider: In large works, application of a premium based on the yield of gas would be awkward, because, not having a station meter for each separate bench, one cannot make the men of one gang dependent upon the inferiority of another gang. On the other hand, the work is distributed among the coal wheelers, the chargers, the firemen, &c.; and among the first classes of workmen and the stokers there is not that mutual dependence requisite for establishing a premium on the yield of gas. In average sized and small works, on the contrary, the workmen are formed into undivided gangs for the total work; and I prefer this organization of service, because a man who always does the same work—either carrying, charging, or stoking—will be much more fatigued at the end of the day, and more rapidly worn out, than a man who, by a rational division of the total work, has passed from one operation to the other several times in the course of the day. Diversity of manual or intellectual occupations gives repose not only relative but real. Consequently, I have always formed my furnace men into a general gang, alternately working at the various operations of their task. There is thus a real interdependence in efforts, and in the result obtained; so that all the men can be given an interest in the profits of extra manufacture. This I did in the works of "X," where for above 10 cubic metres of gas manufactured per retort per hour, I allowed 0·50 fr. to the first stoker, 0·35 fr. to the others, and 0·25 fr. to the assistants. In winter I had four ordinary furnaces with nine retorts, 2·90 metres in length. Each furnace had a stoker with two assistants per relay; there being one assistant for every two furnaces per day of 12 hours. One of the stokers had authority over the entire gang at each relay, and 0·25 fr. extra pay. The work of coal carbonization thus comprised each 24 hours—

2 stokers at 5·25 frs.	10·50 frs.
6 „ „ 5·00 „	30·00 „
4 „ „ 4·50 „	18·00 „
12 men at a cost of	58·50 frs.

The coal was taken in the store; and the coke as quenched was conveyed to the coke-breaker. The total amount of coal carbonized was (at the rate of five charges per 24 hours and 155 kilos. per retort) 27,900 kilos.—viz., an average kilogramme-day of 2325 kilos. Though the method was satisfactory, the yield, per contra, did not exceed 28 cubic metres per 100 kilos. —viz., 7800 cubic metres per 24 hours—at a cost of 58·50 frs. for manual labour, or 7·50 frs. per 1000 cubic metres. Not only could the yield be improved, but some days (chiefly Saturday) there was greater reason to augment the output—the consumption being over 8000 cubic metres. It was then that I applied the system of premiums, which gave me excellent results and satisfied the men—avoiding intermittent lighting of a fifth setting. I gave the above premium when the output exceeded 10 cubic metres per retort hour—viz.:

2 chief stokers at	0·50 fr.	1·00 frs.
6 stokers at	0·35 „	2·10 „
4 assistants at	0·25 „	1·00 „
	Total	4·10 frs.

The output then rose from 7800 to 8640 cubic metres; the charge being worked off in 4 h. 48 m., without need of lighting an extra furnace. The extra 850 cubic metres in the output cost 4·10 frs., or 4·76 frs. per 1000 cubic metres, instead of 7·50 frs. I have since found that it was possible to give a further extension to these premiums by regulating them according to an easily applied scale. In works "Y" and "*Z*," the kilogramme-day was increased to 2640 kilos. with an hourly production of 11 cubic metres per retort and a yield of 30 cubic metres per 100 kilos. The extra output above 10 cubic metres per retort per hour was paid for by an additional premium of 5 frs. per 1000 cubic metres or at the rate of 0·05 fr. per 10 cubic metres manufactured in excess. If we make out the account for a day with an hourly production per retort of 11 cubic metres, the increased production, at 5 frs. per 1000 cubic metres—viz., 4·32 frs.—gave each workman an extra 0·36 fr. The total wages we distributed as follows: —

	Initial Wages.	Premium for Production of 10 cm.	Extra Premium for Production of 11 cm.	Total Wages.
Chief stoker	3·25	0·50	3·06	6·06
Stokers	5·00	0·35	0·36	5·71
Assistants	4·50	0·25	0·36	5·11

In his evidence before the Quinquennial Commission of 1890, M. Melon gave the cost prices for 1000 cubic metres of gas as follows:—

Manual labour in carbonization	6·34 frs.
Accessory expenses	1·38 „
	7·72 frs.

The above results are less than this valuation. If the coal-store and the coke quenching yard are not too far away from the retort-house, there would be an advantage in passing from carbonization in 4 h. 48 m. to that in 5 hours, reducing the charge of the retort. Thus at works "*Z*," with new settings of seven retorts, I obtained as much as 300 cubic metres per retort per 24 hours, with 4-hour charges. I mention this local peculiarity that they obtain at works "Y," as regards the handling of the coal and coke, yields per man-kilogramme greater than those at "*Z*" (at "Y" the men drink wine and at "*Z*" beer); whereas the stoker-kilogramme was greater at "*Z*," which is in an iron

foundry district, where stokers can be found more readily who are accustomed to work at fires. The premiums were thus regulated: On the starting of each gang the engineman or foreman noted the index of the station meter, and the premium was fixed in the office for each gang and day without regard to the productions of the previous or following days. Moreover, the meter was only read two hours after the starting of the gang, so as to prevent any neglect of the furnace through jealousy or the practising of frauds which would affect the two first hours' work of the succeeding gang, and among which I may mention that commonly called "*rhabillage*" of the retort, which consists in covering a burnt-off charge with coal. It is to be observed that when stokers are given an interest in carbonization—the quantity of coal per retort being greater and better distributed—the yield of gas increases, the men attend better to the furnaces, and consequently the amount of fuel employed per 1000 cubic metres of gas is less. A direct premium might also be given for the most complete utilization of fuel on a minimum production of coke screened from the furnace cinders. The premium on gas manufacture is excellent, both for the works and for the workmen whose wages it augments, and not only indemnifies them for their extra strength, and the food they have rightly expended through doing more work, but also leaves them a bonus to increase their resources.

Works L.—The stokers (two men for four settings of seven retorts per 12 hours) receive a daily premium variable with the production of gas per retort. This premium (only given for an output of more than 190 cubic metres of gas per retort in 24 hours) is 1 c. for every additional cubic metre of gas manufactured. So that if the production is 200 cubic metres per retort per day, each of the four stokers receives a premium of 0·10 fr.; if the production is 220 cubic metres, the corresponding premium is 0·30 fr., &c. This system did not produce the results one had a right to expect; but this must be on account of the character of the workman (South of Italy), who is easily contented with his fixed wages, and cares little for premiums only to be obtained by extra labour.

Works M.—We do not give stokers any interest in production in the strict sense, but in the distillation of the coal in each retort as perfectly as possible; and we employ the following system of premiums and fines. A monthly premium of 0·50 fr. is distributed, at the end of each month, among those of the firemen and stokers who have had no retorts stopped during the month; and, on the other hand, there is a fine of 0·10 fr. per stopped retort. This amount is withheld from the stoker and fireman of the retort. We call a "stopped retort" that which, after six hours' work, has not its charge of coal carbonized sufficiently, through want of heat in the furnace or bad distribution of coal. In this case, the coal is not drawn from the retort, but remains subjected to carbonizing during a second period of six hours. We endeavoured to give the men some interest in economy of fuel (which is pit-coal), but had to abandon the idea, owing to the ease with which fraud could be practised. In fact, the workmen either added coke from the retorts to the furnace coal or else coal which should have been carbonized. Moreover, we consider that economy of fuel does not depend altogether upon the stoker. It is the engineer or manager who should fix the minimum amount of a given fuel to be employed to carbonize the charge in a given time. He gives this specified amount to the stoker who should obtain the required result, and should not be able to do it with less. The stoker has only the material management of the furnace—viz., stirring the fire, cleaning the grate-bars, &c.; and he should never touch the dampers, the opening of which is regulated by the engineer.

Works N.—Stokers have fixed wages of 3 frs. per day, and also receive premiums according to seniority, as follows: After six months, 0·20 fr. per day; a year, 0·40 fr.; 15 months, 0·50 fr.; 18 months, 0·75 fr. This daily premium is only due to be paid when they are stoking; when in the yard or town, they only receive ordinary wages. They are paid quarterly; but with the reserve that, in case of defective work, I can retain part of the premium in the way of a fine. They also receive the following premiums on manufacture: 5 frs. per month per stoker for an average yield of 29 to 29·50 cubic metres of gas per 100 kilos. of coal carbonized; 10 frs. for a yield of 29·50 to 30 cubic metres; and 15 frs. for 30 to 30·50 cubic metres. I must add that my results as regards yield of gas have not improved in any way—the stokers lose all interest in it. Is this due to the climate? I simply find that my stokers do as little work as possible.

Works O.—In addition to their fixed wages of 3·50 frs., a premium according to seniority of 0·25 fr. is paid at the end of a year's work, and after five years 0·50 fr. Each night and day gang is under the supervision of a head stoker, who has 0·25 fr. above the ordinary daily wages. Each charge of coal is weighed by the man attending the exhauster. The stokers receive a premium of 0·10 fr. per 100 kilos. of coal carbonized beyond the minimum charge of 100 kilos. The premium is not awarded if the yield falls below 29 cubic metres per 100 kilos. Excepting cases of accident for which the foreman considers the stokers are not to blame, he can inflict an additional fine of 0·10 fr. per charge not properly worked off. If the yield exceeds 30 cubic metres per 100 kilos. of coal, the premium is increased to 0·15 fr. The engine-man working the exhauster has a premium of 0·25 fr. when the yield is more than 29 cubic metres per 100 kilos., and 0·50 fr. when more than 30. He must pay a fine of 5 frs. if, through over-exhaustion, the illuminating power of the gas is not in accordance with regulations. The two engine-men both note the figures of the meter when the gangs are changed, so as to have the work of the two gangs separate; this change from day to night service being every eight days. An extra premium of 0·10 fr. per man per day is awarded to the gang which has manufactured most gas in a fortnight. This system of premiums, which was applied when the works used only direct firing, was partially abandoned when regenerative furnaces were adopted; and owing to the complication of the wages bill, only the premium on coal was retained. The regenerative furnaces made it possible to obtain the same results of yield as with the premiums, which were replaced by an increase of fixed wages.

Works P.—The stokers and foremen here are interested in the yield of gas. In addition to their fixed daily wages, the former receive a premium of 0·25 fr. per day when their work is well done, and the yield of gas consequently good. Furnace superintendents receive a premium varying from 0·05 fr. to 0·10 fr. per 1000 cubic metres of gas manufactured if the yield does not vary beyond the limits of 29 to 30·2 cubic metres per kilo. of coal carbonized. A fine of 1 fr. to 5 frs. per 1000 cubic metres is inflicted if the yield is less or greater than the above.

Works Q.—Our stokers have an interest in the yield of gas owing to the monthly premium of 20 frs. when the average monthly yield has been 29 to 30 cubic metres per 100 kilos. of coal carbonized. If this yield is exceeded, or not attained, no premium is awarded. This very simple method—for which we have only to congratulate ourselves—has been applied for many years in the seven works belonging to the company. To attain this result, the stokers take care not to over-heat the retorts uselessly, and to keep them in good order.

Works R.—The application of a system of premiums on manufacture has been made in our works for ten years. The principle is to encourage the employees to improve the yield of gas and secure economy in firing. These premiums are awarded according to rules, the chief clauses being as follows: As the establishment of premiums must be based upon the effective results obtained during the term, the unit coefficients employed for reckoning the premiums cannot be definitely fixed until six months after the end of the term in question—viz., in the month of January of each year. At this date the Administrative Council of the Company make known the rate of these premium coefficients, which they have established—reckoning all the elements of cost price, and particularly: (1) Duration of retorts and furnaces; (2) amount of coke employed for firing; (3) illuminating power of the gas manufactured. As each of these elements has a preponderating influence on satisfactory working, any deficit in one of them would respectively involve suppression of one-sixth of the premium. To facilitate the application and distribution of the premiums, they are of two kinds: (1) A work-premium proportionate to the total quantity of coal carbonized; and (2) a yield-premium proportionate to the production of gas above the normal yield of 29 cubic metres per 100 kilos. of coal carbonized, taken as a basis and minimum production. Each of these two kinds of premiums is established monthly according to the figures in the carbonizing book, and on the following data: 1. The work-premium according to the indications of the weigh-bridge at the coal-store. (2) The yield-premium according to the index of the station-meters. During the first fortnight of each month, a notice is posted up to inform the employees as to the amount of coal carbonized and gas manufactured during the previous month; and a Committee composed of one representative from each of the classes interested is called upon to verify the accuracy of the accounts compiled under the care of the deputy-manager of each works. However, as these premiums must not be obtained to the detriment of the normal working of the establishment, they are subordinated to the three elements of cost price already mentioned. Any infractions of the regulations, as regards limits, cause a reduction in the total premiums of the year to the extent of one-sixth for each of these three elements. Distribution of the premiums is made to the stokers according to the number of days they work; and for the foremen and superintendents, 50 per cent. is added to their days of work in calculating the premium. All infractions of rules inside the works, all offences against discipline, and all faults or serious carelessness during work or service, cause the premium of the offender to be suppressed; and likewise in the case of workmen who have brought about disorder or excited their fellow-workmen to a neglect of discipline, in the case of those who leave the works without reasonable pretext or permission, and in the case of those who maliciously damage the Company's property. As regards premiums from the practical point of view, we consider that if, to some extent, we obtained an improvement in the yield of gas and regularity of charging the retorts, the labour of manufacture, on the contrary, through the various causes, has grown perceptibly and continuously more expensive during the last ten years; so that the economy in maintenance, &c., has been greatly affected. The total annual amount of the premiums attains an average of 20,000 frs.—equivalent to an increase of about 0·35 fr. in the stoker's daily wages. In a word, the application of the system has not given all the advantages one had a right to expect, though satisfactory to the stokers and others.

Works S.—When you have given a stoker the means of living (as regards food and lodging, provision for old age, &c.), you will find him willing to devote himself to his work. Then you can establish premiums—variable in different works, but always intended to be employed for rent, time of sickness, or an old

age pension fund. A stoker can, by assiduity, improve the yield of gas and economize fuel; but he should be encouraged by giving him a share in the results, by means of premiums. I think that the total amount of the premiums should be about 20 per cent. of the average wages and economy realized, in order to obtain the desired object.

WORKS T.—Stokers need a great deal of supervision; and it is the fear of losing their employment which influences them. This I regard as the most important factor for gaining the required results. When a workman lives at the works, he has a better opportunity of associating with his employer, and becoming well disposed if the employer evinces an interest in him. Thus he will be steadier and more zealous. If he has the means of living in his family, he will be an industrious, disciplined servant, regular in his service. In such a case, premiums will be useful, because they will benefit the family; whereas they are injurious when they lead the workman to the public-house. By thus improving his condition, more certain results can be obtained than by other systems of sharing profits—complicated and difficult to apply.

C.—*Provident Institutions.*

This inquiry demonstrates how different are the means and results obtained according to the peculiar circumstances of each works. However, it enables me to give some general principles, instructions, and figures, which will be useful in the various cases.

The two last-mentioned replies express the opinion that, for good work, a good workman is needed; and that if one wants a good workman he must be assisted by provident institutions to improve his physical and moral condition, and encouraged by certain advantages to be steady, economical, and laborious.

Premiums on manufacture certainly stimulate a workman, and we have seen from the result of the inquiries that payment is often deferred to some distant date so as to make him economize as far as possible.

This method is, however, necessarily imperfect, and the workman is led away by the temptation (so dangerous on account of his improvidence) of spending the money he receives, often in a way injurious to himself, especially when he is unfortunate, and wishes to drown care for a moment. He is thus left defenceless against the risks of life, sickness, and old age. In the second part of this work, I shall briefly discuss the means employed to provide against these risks by institutions.

(To be continued.)

TECHNICAL RECORD.

THE DEVELOPMENT OF ARTIFICIAL LIGHTING.

The last of the volumes of abstracts issued by the Institution of Civil Engineers contains the following summary of an interesting article on the above subject, by Herr C. Kjær, which appeared in "Ingenioren," of Copenhagen:—

Starting from the oil-lamps of antiquity and the use of these lamps latterly with petroleum, this long historical and critical review notices Murdoch's invention of gas lighting in 1792, and traces the subsequent development of artificial lighting down to the Electric Exhibition in Paris in 1881, which was followed by the rapid spread of electric lighting in Europe.

The Welsbach mantle in 1886 provided an incandescent gas-lamp which not only reduced the consumption considerably, but also gave a better light than the electric glow lamp. It opens a wide future for water gas, which, though of no illuminating value when not carburetted, develops in this condition the high temperature necessary to make the mantle glow. In the Dellwik process, the object is to produce carbonic acid during the blowing, whereby more than three times as much heat would be developed as when carbonic oxide only is formed from the same quantity of carbon. Though this aim has not yet been successfully realized in practice, from 13 to 20 per cent. of carbonic acid has been reached, against only about 6 per cent. in the older processes; while the yield of gas is likewise greater, and the blowing is reduced to only about 1¾ minutes for 7 to 8 minutes of gas making. In Copenhagen, the make of water gas is about 700,000 cubic feet per day. Dr. Leybold, of Hamburg, gives 0·46d. to 0·54d. per 1000 cubic feet as the total cost of production for carburetted water gas of 16-candle power, and 0·64d. to 0·76d. for 20-candle gas; including 0·15d. for wages in each case. It seems likely that lighting by water gas in combination with the Welsbach mantle will enter upon a new phase, and thereby secure a place by the side of electric lighting for a long time to come.

Acetylene gas is now produced at the rate of about 4·8 cubic feet per pound of calcium carbide; and the production of the carbide itself requires an average expenditure of about 2·2 E.H.P. hours per pound. Where ordinary gas or electricity is not available, acetylene certainly has its advantages.

Electric lighting of lamps in series has been accomplished to a certain extent by Herr von Hefner-Alteneck with differential arc lamps, and also with shunt arc lamps; but the latter to the number of two or three only. Lighting in parallel renders each lamp independent of all the rest, and is certain to be employed in future, either by itself or in combination with lighting in series. Latterly the aim has been to reduce the consumption of electricity by constructing the lamps for higher tension and lower strength of current; 220 volts are now being employed instead of 110 volts, and double the number of lamps are supplied through the same conductors. In the American Jandus lamp, the arc and carbons are contained in a closed transparent cylinder, from which the air is excluded. Instead of the usual 10 to 16 hours, the carbons here last 100 to 200 hours; and their points are five to seven times farther apart. But the economy is less, because the light has to pass through the enclosing cylinder, and more is in consequence thrown up by the longer arc.

The fact that magnesia, lime, and other metallic oxides are insulators while cold, but when heated to a dazzling white heat become good conductors long before their melting-point is reached, was taken advantage of by Professor Nernst, of Göttingen, in his invention in 1898 of a glow lamp on a new principle. A little stick of calcined magnesia, 7 mm. (0·28 inch) long and 1½ mm. (0·06 inch) diameter, when heated in the open air by an alternating current of 118 volts and 0·23 ampère, or 27 watts, gave 31-candle power, or 1·14-candle power per watt. Such a magnesia stick hangs freely and vertically within a fixed cylindrical bell of insulating material, which is wound inside with a coil of platinum wire connected in parallel with the main circuit. Attached to the top of the bell, and concentric therewith, is an upright solenoid, in which the iron core is suspended by a helical spring from a fixed point overhead, so as to move up and down within the magnetizing coil. From the bottom of the core, the magnesia stick is suspended inside the bell by a wire connected in series with the magnetizing coil; and from the bottom of the magnesia stick another wire is led to the main circuit. On closing the circuit for lighting the lamp, the current at first passes only through the platinum coil inside the bell, because the parallel circuit through the solenoid and magnesia is blocked while the latter is still cold and non-conducting. But the heat from the platinum coil being concentrated upon the magnesia renders it in a few seconds hot enough to become conducting. The current then passes through it to the solenoid, the iron core is drawn down into the centre of the solenoid; and the glowing magnesia suspended from the core, being thus lowered clear below the bottom of the bell, gives out its light all round. By this movement the platinum coil is automatically cut out of circuit, and the whole current henceforth flows only through the magnesia and the solenoid. The magnesia suffers no diminution in brilliancy from length of burning in the open air, as the metallic oxide undergoes no change by heating in air. In all likelihood the Nernst lamp will not supersede either the arc or incandescent lamps of older construction, but will take a place of its own, intermediate between them.

A summary of his review is presented by the author in the following tabular form:—

Comparative Cost of 500 *Candle-Power-Hours with Different Modes of Lighting.*

Kind of Light.	Lamps and Burners most frequently Employed.		Cost in Denmark.		Heat Developed per Candle Power per Hour.	
	Candle Power.	Consumption per Hour.	Lighting Medium.	500 Candle-Power Hours.		
				Pence.	Cals.	Th.U.
Electric—						
Arc	650	422 watts	7·31d. per	2·37*	0·562	2·24
Incandescent . .	16	50 ,,	kilowatt	11·42†	2·700	10·75
,, (Nernst)	50	75 ,,	per hour.	5·48	1·296	5·15
Retort gas—						
Argand burner. .	32	8 83 c. ft.	5s.	8·31	42·12	168·0
Flat-flame burner .	16	5·64 c. ft.	per 1000	10·64	54·00	215·0
Welsbach mantle .	50	3·35 c. ft.	cubic feet	2·02‡	10·25	40·7
Non-carburetted water gas with Welsbach mantle	50	5·29 c. ft.	2s. 2d. per 1000 cubic feet	1·40‡	7·80	31·0
Acetylene gas . .	50	1·14 c. ft.	2·42d. per lb. of calcium carbide, equivalent to 4·8 c.ft. of acetylene gas.	5·76	9·02	35·8
Petroleum. . . .	30	0·18 lb., or 0·0225 gall.	9·68d. per gallon.	3·53	23·00	91·4

* Add 0·205d. for renewal of carbons. † Add 0·286d. for renewal of the lamp itself. ‡ Add 0·133d. for renewal of mantles.

Under favourable circumstances, the ordinary incandescent lamps utilize as light only about 7 per cent. of the energy expended, and the Welsbach light only about 2 per cent.; the rest goes in heat. The ultimate aim of science is therefore the production of light alone, without heat; and, from the close analogy between electricity and light, it is conceived that this aim may in the future be realized by means of electricity.

ELECTRIC CURRENTS AND GAS AND WATER MAINS.

Our contemporary the "Engineering Record" has lately been devoting some space to the above subject. It appears that a short time ago the Commissioner of Public Works of Providence retained Mr. A. A. Knudson, of New York, to make an investigation of the electrical condition of the water-mains in that city. Mr. Otis F. Clapp, the City Engineer, and Mr. J. A. M'Kenna, of his staff, assisted Mr. Knudson in his work; and Mr. Clapp states that observations will probably be made at short intervals in future, so that the authorities can keep in closer touch with what is going on underground. Mr. Knudson's report is an important document in many ways; and the following abstract, taken from our contemporary, will furnish some idea of the extent and results of his examination.

One of the laws governing electricity is that when more than one path is offered for a current to flow, such currents will distribute themselves among the different paths in proportion to the conductivity of each. In Providence, these paths are the railway tracks and feeders, the earth, the water and gas mains, and any other underground metallic structures. The rails of a newly constructed road with well-bonded joints and track feeders generally at first return the larger proportion of the current; but the rail bonds often break, or through corrosive action their electrical contact with the rails in time is impaired, and the proportion of current which follows the water and gas mains is increased. Where the current enters the metal, no harm is done; where it leaves the metal for earth or water, more or less damage occurs. The tendency of electrical currents is always to pass from points of higher to those of lower potential. In the report, where the tendency of the currents is to enter the water-mains, they are called "negative," and where it is to leave them they are called "positive." In addition to this, it should be noted that, owing to the character of cast-iron pipe-joints, there is always a tendency of a portion of the current to pass from each 12-feet length of pipe through the earth or water around the joint into the next length; and wherever this occurs some damage must result.

Something like 123 potential tests were made between the water-mains and the rails of the Union Railroad Company. A number of tests were also made at each of fifteen different locations, to determine the efficiency or condition of rail bonds at turn-outs, switches, &c. The outside surface of the water-mains was examined at eleven excavations, and both outside and inside at one, where the pipe had been removed from a street. In a section of the city where the water-mains are alternately positive and negative to the rails, it was noted, when the readings were taken, that the mains were generally positive during the absence of cars. When a car approached and passed, a reversal would take place—the current going from rails to mains to a much higher degree. A marked exception was the terminus of one line, where a difference of potential of 12·5 volts was noted.

In what may be termed the steady positive district, tests were made on the new fire service system of water-mains. It is noted that all of them are positive to the rails. The voltmeter readings are about the same as on the regular low-service mains at the same points; there being no material difference of potential between the two. While these readings are not high—ranging between one and two volts—it is not a healthy condition, and it is probable that electrolytic action is taking place at various points on the outside, or near the joints on the inside of the pipes. There was no evidence of such action on the outside of this pipe at the excavation. The pipe at this place was located in a peculiarly dry, sandy soil of high electrical resistance, and the most natural place for injury to occur would be on the inside of the pipe near the joints.

Special attention is called to the conditions on the Smith Street line, where a 24-inch main runs for more than two miles within 3½ feet of the tracks. Here the readings were from 4 to 6 volts; showing that the main was receiving and carrying a considerable amount of the return current of the line. This was confirmed by an inspection of the pipe at the excavation, where electrolytic pittings were discovered on the positive side of the joint. From the fact that this type of pittings was found at this joint, where the pipe was embedded in sandy soil scarcely damp, it is more than probable that this action is going on to a more marked degree in other places where the main may rest in soil of a character more conducive to electrolytic action, and on the inside near the joints anywhere along its length.

In looking for a possible cause of the high difference of potential along this line, a rail joint and bond was uncovered, of which a view is reproduced. Taking this rail joint to be a fair sample of others on this line, it will be noticed that the small two-bolt fishplate is not such as to ensure firmness of the rail ends; consequently, owing to their movement through car wheels passing over them, the copper bond is liable to become loosened from the rails or broken. The voltmeter readings indicate that such a condition prevails. This method of joint construction does not compare favourably with the cast-welded joint found at many places on the railway lines in Providence. If it is desirable to have cast-welded joints on other lines in the city, it is much more so over this large and important water-main. Besides the question of electrolysis, the jolting and jarring of cars over an uneven track is liable to cause at some point in the two miles a settling of the earth, which may result in opening a joint of the water-main, and in a leak that may deprive a portion of the city of water for a time, and be costly to repair.

That such joints and bonds are of little electric value is evident from an examination of a loop line. The voltmeter readings were mostly negative; the highest being at two points. While taking a reading at one point, the needle suddenly jumped from 2·5 to 9 volts negative. A car was noticed at the time passing over a turn-out switch. Suspecting defective bonding, tests at the rail ends of this turn-out were made; and the very same reading was obtained between two rails as between the hydrant and rails about half a block distant—viz., 9 volts. At another place between the rails the reading was 6 volts. These two rail tests showed at once that the bonds had either become corroded where they connect with the rails, or actually broken and were useless for the purpose intended. At a second visit to this turn-out a few days later, a repair gang were found lining up rails and rebonding. A photograph was taken of one of the bonds, broken at one end and corroded at the other, which was removed from this turn-out where the high voltmeter reading was obtained; and a view of the two ends is furnished in the accompanying illustration as a sample of what a rail bond may become when left to itself.

The excessively high reading on another line (21 volts) led Mr. Knudson to look for a special cause, which was found at a point where, in putting in a sewer, a separation in the rails was made; causing the unusual flow of current on that section of the railway line to the water-main. After the rails had been connected a few days later, a second test was made at this terminal, and the reading was found to be 8 volts, or a reduction of 13 volts by connecting the rail ends. This is a good illustration of a road with defective rail bonds; the separated rails in this case being equivalent to poor bonding.

Passing over the portion of the report referring to a number of lines where the voltmeter readings—one as high as 8·5 volts—showed that the mains were receiving current from the rails, the peculiar electrical conditions at one portion of the line are the next interesting feature. The voltmeter readings over the entire line were excessive—indicating a heavy flow of current into the mains; and evidences of electrolytic pitting were noticed on the bell of a pipe which was uncovered. The railway line at the spot in question makes two turns or angles; and the interlacing water-pipes are located in the inside of these angles. The most direct course, therefore, for the current to return would not be by the rails, but by the short cut across the angles. In other words, instead of passing over the two sides of a triangle and following the rails, the current takes but one side—that being water-pipes, and to some extent the gas-pipes as well. After reaching the water-mains, there are two return paths—one east, through a 12-inch main, the other west, to a 30-inch main.

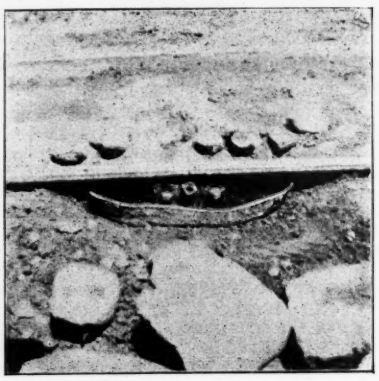
Several districts were found where the water-mains were generally positive, with readings indicating danger. One street line is also strongly positive through its entire length. The power station being located in this street, tests were made in its vicinity; but nothing of importance was shown—the readings being both ways to a comparatively small degree. At another place, however, the tests showed a higher range—the indications pointing to damage to the mains. An excavation was made here, and also one at another point. At both of these places the pipes were in unusually dry soil, and no signs of electrolysis were found on the outside of the pipe at either place; but the mere presence of current flowing on the pipes is a sure indication that it is passing out and injuring them somewhere on the inside or outside, or both, although not discovered at the precise points examined, where differences of potentials are found.

On the east side of the city no special features of importance, as in other cases, were developed in the tests; but they are useful in showing that a steady positive district was being approached towards the south. A few tests were made in one district between the water and gas mains; the result showing that railway current was passing from the former to the latter through the earth, from which in some other locality a portion was again doubtless passing from the gas-mains to earth and the short cut by the river. Five tests were made between water-mains and the river, all of which showed current flowing from them towards, and into, the river. In view of these tests, it becomes clear that railway currents collecting on the mains at distant points find their way to the water-piping in this section of the city—one portion going to earth and the river, while another portion, taking the other path, remains on and follows the mains; thus, in this sense, illustrating the law governing such currents, as mentioned at the beginning of the report.

Referring to bonds, the report states that a perfect rail-bond should continually equal the conductivity of the rail itself. Some bond makers claim a conductivity of 100 per cent. of continuous rail (the cast-weld is one of these); others somewhat less. The actual efficiency of bonds tested will be understood when it is stated that through a lineal foot on a rail of ordinary size it is seldom that 1 millivolt difference of potential can be obtained, or 0·001 volt; whereas, in many of these tests, in which the joint is included in the lineal foot, the difference of potential is more than 1 volt, and in two instances it rises to 6 and 9 volts. One-tenth of a volt is considered excessive, and indicates that the bond is losing its electrical contact with the rails. It is even more important that the contact between return-track feeders and rails should be perfect. Only one such point

ENDS OF BOND.

CAST-WELDED JOINT,



JOINT ON SMITH STREET LINE.

was examined, and it showed differences of potential between the feeders and rails as follows: First rail, 0·3 volt; second rail, 0·2 volt; third rail, 0·2 volt. Wherever these differences of potential occur, the tendency is to an increased diversion of current into the ground and water-mains.

At the eleven excavations, the water-mains were carefully examined for evidence of electrolysis, and millivolt tests for current through them were made at each place. Most of them were in soil which was sandy, and in some cases hardly damp, although there had been recent rain. This condition of soil is not such as to favour the flow of current from the mains, owing to its high electrical resistance, and thereby to cause electrolytic action at such points. In some cases, however, where the soil was more favourable, and the flow of current in the main excessive, electrolysis pittings were found, but not of an immediately serious nature, so far as could be seen, as in all except one case the action was on the bell end of the joint, where the metal is heavier than at other portions. The exception mentioned was where the effects of electrolysis were found at the spigot side of two joints—the current in the pipe flowing in the opposite direction to the other cases. This is a condition which should cause concern, and warrant early attention; for, though the damage is not serious, as found at this point, there may be many other joints in this main located where more favourable conditions prevail, and cause electrolysis to be more active and damaging.

In the list of pipes uncovered at the eleven excavations, there are five at which no signs of electrolysis were found. Of the remaining six, none had reached a stage that could be considered serious. But from the diagrams and their explanation in the report, it is apparent the investigation was not undertaken any too soon. That corrosive action on the Providence pipes has commenced, is plainly evident.

While it is not within his province to specify methods to be used by the Railway Company to better control their currents, Mr. Knudson recommends that attention be called to the necessity of early action, to correct the excessive escape discovered in the negative districts; also that the defective bonding specified in the turn-outs should be promptly attended to. Not only should the bonds be renewed, but the frogs and switches at all other turn-outs should be tested, and those found defective promptly renewed. It is the practice on some electric roads to periodically examine, by methods of testing, the entire bonding system of their lines, and promptly repair those found defective. Attention should first be given to reducing the escape of current to the water-mains in the negative districts. When this escape has been lowered in the negative localities, corresponding reduction may be looked for in the positive districts. There can be no assurance of complete immunity from electrolytic damage to water-mains caused by the straying railway currents so long as the single trolley system is used, in which the rails form one side of the circuit, and are in contact with the earth. Current which once enters the water-mains must leave them at various points, and more or less inside or outside near the joints, over the entire system; and wherever the smallest fraction of current passes out through earth or water, some injury to the mains must result. The destructive action may be slow, and go on for a long time unnoticed; but it inevitably and seriously shortens the life of the pipe.

It is suggested that when future extensions of lines are asked for by the Railway Company, such requests should be first referred to the City Engineer, to ascertain the size and location of the water-mains in the streets over which the new line is proposed to run. This is advised with a view to avoiding such a condition as that found in Smith Street, where, as already stated, the tracks of the road are placed directly over the important water-main, when apparently they could just as well have been located upon the opposite side of the street.

The following article from a recent issue of our American contemporary bears upon the subject of the electric conductivity of water-mains:—

During the last four years, while the pipe-laying of the mains of the Massachusetts Metropolitan Water-Works has been in progress, a favourable opportunity has been furnished for the study of electrolysis. Some of the results of this study were recently communicated to the New England Water-Works Association by Mr. W. E. Foss. When the investigation was begun, towards the close of 1896, it was seen that a knowledge of the electrical resistances of pipe-lines of various diameters would be of value; and measurements to determine these resistances have been made on all convenient occasions. It was found that the conductivity of such pipes, in which no attempt was made to obtain a uniform electric contact at the joints, varied largely in lines of the same diameter, and even in different portions of the same line. All the measurements were made with the pipes laid in the ground; a measured current being allowed to flow through the pipe, and the drop in potential in a given length of main determined. The amount of current was from 10 to 140 ampères.

While laying pipe-lines, currents of from 20 to 100 ampères have been obtained by connecting the ends of sections with a No. 8 copper wire before the sections were united. At the point where the largest current was measured, a wire nail 0·1 inch in diameter was heated to a white heat when placed between the ends of the 48-inch pipes before the sleeve used in making the joint was put on. The following figures show the resistance of the mains:—

Diameter of Pipe. Inches.	Ohms per 1000 Feet.	Remarks.
12	0·021	New pipe; never filled.
16	0·027	" "
16	0·060	Filled; used six months.
20	0·020	" "
24	0·028	Empty; used 18 months.
36	0·012	New pipe; never filled.
36	0·029	" "
36	0·035	" "
48	0·004	" "
48	0·016	Filled; used over six months.
48	0·018	New pipe; never filled.

In a letter to the same Society, Mr. E. E. Bromwell stated that the electrical resistances of any pipe-line in streets with parallel conductors, such as gas and water mains with their service-pipes, can never be obtained with any marked degree of accuracy. Moreover, the resistances of gas-mains of like material and size are from 10 to 15 per cent. higher than those of water-mains.

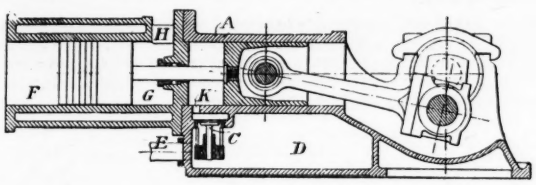
The tests of which the following table is a summary were made at a considerable expenditure of time and money to secure conditions giving as accurate results as possible. The current was taken from accumulators; and Weston instruments just calibrated were employed in making the measurements. These pipes were completely isolated from any other conductors, and remote from any electrical influence of any kind, even to the grounding of a single telephone—the dry, gravel soil being the only variable factor. The pipes had been laid for periods ranging from five to ten years. The figures give in each case the average of ten independent readings; the greatest variation found being less than 4 per cent. in each series. Readings of the same class in a crowded street, with a good many adjacent pipe-lines, varied from 20 to 300 per cent.

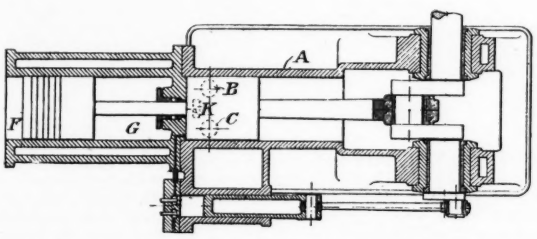
Diameter of Pipe. Inches.	Ohms per 1000 Feet.	Current. Ampères.	Drop. Volts.
4	1·840	8·0	14·720
6	0·792	11·2	8·890
8	0·432	12·4	5·350
10	0·275	12·1	3·320
12	0·187	13·2	2·460
16	0·104	12·2	1·260
18	0·081	12·2	0·988
20	0·065	12·6	0·819
24	0·045	11·8	0·504
28	0·033	11·1	0·369
30	0·029	11·0	0·319
36	0·015	11·2	0·168

REGISTER OF PATENTS.

Two-Stroke Gas-Engine.—Abel, C. D.; a communication from H. Eckhardt, of Berlin. No. 11,263; May 30, 1899.

In two-stroke-cycle gas-motor engines—in which the combustion gases are cleared out of the working cylinder by means of a charge of compressed air produced without the use of a special pump—either the front end of the engine cylinder is utilized as an air-pump, or the crank-shaft is enclosed in an air-tight casing for the purpose. These arrangements, the patentee points out, have the disadvantage that, on the one hand, the dead space is very considerable, and, on the other hand, the compressed air supply comes in contact with the hot outer surface of the engine piston, so that an effectual cooling of the latter by means of cold air is not possible. The present invention relates to a construction of such two-stroke engines whereby these disadvantages are said to be obviated.





As shown, the guide A for the piston-rod and connecting-rod is constructed as a cylinder, to serve as a clearing air-pump, in such manner that the crosshead is formed as a piston. Air is drawn into A through a valve B, and is forced through a valve C into the air-chamber D, whence, at the required moment, the compressed air is led through a pipe E into the engine cylinder F. The front end G of the latter is in constant communication with the outer air, by means of the opening H; so that the piston will be effectually cooled.

With motors in which a supply of compressed air at higher pressure is required (such as for spraying liquid combustible, &c.), a portion of the air forced by the pump A into the chamber D can be led thence into a separate chamber, to be there retained at a higher pressure. This pump-chamber is in direct communication with the clearing-out pump; so that the pressure produced in the latter can be directly transferred to the separate chamber.

The combined action of the two pumps is as follows: The piston of the clearing-out pump A draws in pure outer air during its outstroke; and forces it, during the greater part of its instroke, through the channel K into the air-chamber D, in which the pressure may (for example) be increased to about half an atmosphere above atmospheric pressure. At a certain moment, the channel K is closed by a suitable device, so as to stop the supply to the chamber D. Or, instead of employing a special device for the purpose, the closing of the channel can be effected by the pump-piston itself, as shown. The air still contained in the pump-cylinder A, after the piston has passed the channel K, is forced into a small auxiliary compressing-pump; and here the air is still further compressed to the required degree by a plunger. The clearing-out pump A therefore supplies the air drawn in by it into two separate collecting chambers of different capacities, of which the larger one D serves to receive the clearing-out air supply of low pressure, while the smaller one serves to receive the air to be compressed at a higher degree.

The strokes of the two pump-pistons are, however, more or less shifted relatively to each other, according to the degree of higher pressure required; and the angle between the two cranks will have to be determined correspondingly.

In consequence of the direct connection of the small pump with the clearing-out pump, the suction-valve of the former takes the place of the discharge-valve of the latter as soon as the piston of A has passed beyond the passage K. And so the suction line of the high-pressure indicator diagram of the smaller pump will coincide with the discharge-line of the low-pressure diagram of the larger one.

Internal Explosion Engines.—Gardner, E., T. H., & L., of Manchester. No. 16,536; Aug. 15, 1899.

This invention relates chiefly to the type of internal explosion or combustion engine described in patent No. 18,210 of 1897, in which "the various functions or phases of the engine are controlled and effected by eccentrics on a stud parallel with the crank-axle, which do not permit of a separate cam for each valve, as in engines which have a lay-shaft." The object of the present invention is to provide for the more effective controlling and timing of the ignition, by a simple arrangement of devices operated by the eccentric which controls the inlet-valve. In this connection, the patentees claim the use (in ignition-timing devices for internal combustion engines) of: A valve casing; a valve and spindle within the casing, for controlling the communications between the compression and ignition chambers and the outside atmosphere; a rock or carrier lever, mounted upon a fulcrum adjacent to the spindle-end; and a trip-lever mounted upon a fulcrum carried by the carrier-lever, and adapted to press against the end of the spindle during the compression stroke of the engine, under the action of a spring, and to lose and regain its abutment with the spindle by the action of a sliding bar or rod.

Purifying Water Gas.—Boult, A. J.; a communication from J. E. Goldschmid, of Frankfort-on-Main. No. 19,270; Sept. 25, 1899.

The patentee proposes, for the purpose of purifying water gas at a distance from the gas-works (by choice in the ordinary supply-pipes, and as near to the consumer as possible), the insertion in the supply-pipe of an oxidizing agent—preferably permanganate salt, in the form of a dry cartridge, with or without the admixture of an inert material, so that the gas in passing comes in contact with it.

It is a well-known fact, the patentee remarks, that water gas is very often polluted with "volatile iron-carbon-oxide combinations." When such water gas is used for lighting purposes in connection with incandescent burners, small quantities of these combinations become decomposed, and produce on the mantle a brown deposit of, probably, oxide of iron, which very soon interferes with the illuminating power of the mantle. In order to overcome this drawback, it has been proposed to free the water gas from the iron-carbon-oxide, by passing it through red-hot tubes, or through suitable acids (see Strache's German patent No. 82,816). Lately Dr. Bunte has found that xylol very efficiently absorbs iron-carbon-oxide combinations; and he strongly recommends this carbon-hydrogen combination as a purifying medium. It has been found that the iron-carbon-oxide may be absolutely and easily destroyed by suitable means of oxidization, without interfering with the constitution of the gas.

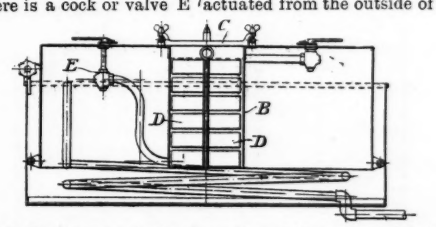
A great number of the known and usually employed means of oxidization will answer the purpose, whether they are employed in a liquid or solid form. Of the liquid means of oxidization, bromine water yields especially satisfactory results; but it is accompanied by the drawback that the purifying process has to be carried out at the central station itself, as it necessitates the construction of special scrubbers through which the water gas is made to pass before entering the pipes. Then it has been found that such an arrangement does not exclude the possibility of danger, as the gas purified at the central station is liable to again form iron-carbon-oxide as it passes along the pipes from the central station to the consumer—thus rendering nugatory the previous purifying success. A similar drawback is also attached to the method recommended by Strache (dealing with the destruction of the iron-carbon-oxide combinations by passing the gas through acids). Dr. Bunte's xylol process, too, is not absolutely free from such drawback.

These inconveniences are, however, absolutely avoided by using instead of the liquid for oxidization, a solid dry oxidizing agent, for the destruction of the iron-carbon-oxide combinations. Numerous experiments have "demonstrated the surprising result" that it is sufficient for the purpose of freeing water gas from iron-carbon-oxide combinations, to pass the gas through a layer of a suitable dry oxidizing agent preferably mixed with some porous or absorbent material; and especially does this refer to permanganate salts, which, "when applied in a dry state, will remove from water gas rapidly and radically any iron-carbon-oxide combinations."

One or more cartridges or charges of the oxidizing agent (preferably potassium permanganate, perchromate of potassium, or iron oxides or chlorides) are inserted in the piping—either directly before or after the meter—in such a manner that the gas must pass through it either on entering or leaving. It is of great advantage, the patentee remarks, in order to provide the oxidizing agent with a larger effective surface, to mix it with some porous material—such as powdered scoria or infusorial earth—or to saturate some porous material with a solution of the oxidizing agent, and then dry it. The filling of the cartridges with the oxidizing agent, and their insertion in the gas piping is carried out in the usual way. It is clear that, "owing to such an arrangement, there can be no danger of the renewed formation of the iron-carbon-oxide combinations in the conducting pipes, after having been purified at the central station. Incandescent burners fed by water gas purified in this manner preserve their natural power of incandescence as long as they last."

Manufacturing Acetylene.—Rogers, H. J., of Watford. No. 20,048; Oct. 6, 1899.

This acetylene manufacturing plant consists of a gasholder of the ordinary form, with or without guides according to its size. In the crown of the bell of the holder is placed a pocket B (with a sealed cover C) proportionate to the capacity of the holder; and in this is fixed a series of trays D for containing calcium carbide. At any convenient height in the pocket, there is a cock or valve E (actuated from the outside of the bell)



for the admission of water to the trays of carbide, and having its handle moving on a graduated dial, so that the supply of water can be regulated to any required extent. In the body of the holder is a coil of pipe in connection with the gas outlet-main. At the upper part of the pocket B is a cock or valve regulated from above the bell of the holder, and serving to shut off the supply of gas from the pocket.

The action of the apparatus is as follows: The trays D are lifted out of the pocket B, and filled with carbide and replaced; the cover C being afterwards sealed to prevent any escape of the gas. Both the cocks already referred to are then opened—one to admit water to the carbide, the other to permit the exit of the gas from the pocket B into the coil, and thence to the gas-main. Immediately the first cock is opened, water comes in contact with the carbide in the lower tray; gas is evolved; and the bell rises. When this gas is consumed, and the bell again sinks into the water, No. 2 tray comes into operation; and so on, until all the carbide in the trays is converted into gas.

Lighting Incandescent Street-Lamp Burners.—Tee, H., of Liverpool. No. 20,522; Oct. 13, 1899.

According to this invention, there is combined with the main burner (on which the mantle is used) an igniting device, by which the burner "is

readily ignited without liability of fracture or damage." The device consists of a pipe leading from the main gas supply-pipe, and above the main tap, and having on it a tap and a weighted lever or arm, disposed within the lamp, and adapted to be operated by a flap in the bottom.

Fig. 1.

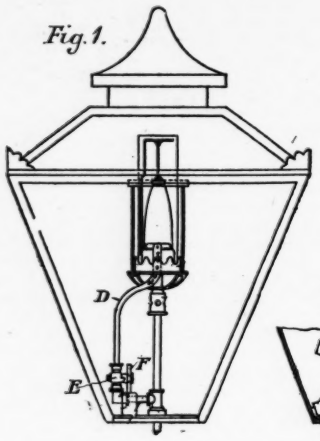
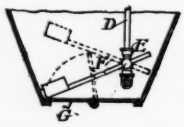


Fig. 2.



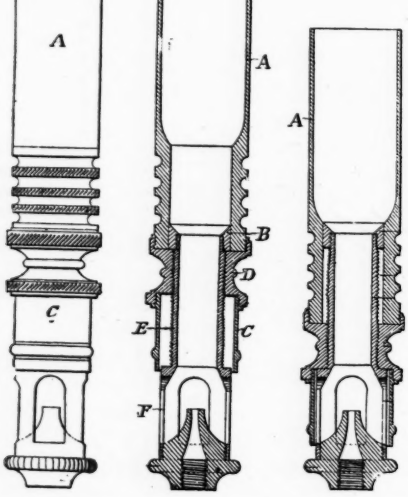
As shown, the upper end of the pilot-light pipe or tube D is passed up between the burner and the gallery, and holes are provided in it at a suitable point, so that, when the lighting torch is passed up through the opening normally covered by the flap G, the gas issuing out of the lower holes will be lit, and the flame will be propagated upwards into the burner by the ignition of the gas-jets issuing through the small holes in the tube. In the act of passing the torch into the lamp, the flap is lifted up, and the lever F (which normally rests on the outer edge—its hinge being disposed between the edges of the bottom) will be raised; and as it is further lifted upwards, the plug of the cock E is turned, and supplies gas to the igniting-tube. When the torch is drawn out, the flap G follows, and so allows the tap-lever F to fall; its return action being effected by the weight. When it reaches the position shown in fig. 2, the tap is closed completely.

Seal-Padlocks for Gas-Meters.—Tourtel, J., of Aldersgate Street, E.C. No. 20,782; Oct. 17, 1899.

This invention relates to improvements on patent No. 479 of 1895, whereby the padlocks referred to are rendered applicable for sealing purposes where wire and lead seals are already employed. For this purpose a hasp is provided, separate from the lock, instead of hinged to it as before. At one end of the hasp is a pin of such a size as is required to pass through the sealing hole of the object to be sealed. The pin also passes through holes in the seal-frame and case of the lock—thus assisting to secure the frame to the case; while the other end of the hasp is made in the form of a hook, so as to engage with the spring-catch of the lock. The remainder of the lock is constructed in a similar manner to that described in the earlier patent.

Burner for Incandescence Lighting.—Noel, P., of Paris. No. 21,086; Oct. 21, 1899.

In this gas-burner for heating and lighting by incandescence, the capacity of the mixing-chamber can be varied, and, at the same time, the opening of the air-supply orifices regulated, according to the pressure of the gas supplied.

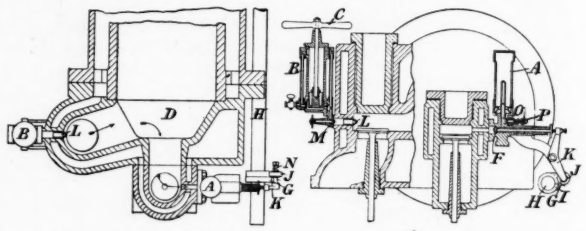


As will be seen by the engraving, the cylindrical piece A, which forms the mixing-chamber of the burner, is made internally of two different diameters—the larger part for the expansion of the gases, while the smaller receives a piston B, which serves to modify the capacity of the chamber. A sleeve C is firmly connected to the main chamber by means of a ring D, forming a nut, in which can be moved a screw-threaded stem E. This is made with a quick thread, and has the piston B secured to its upper end, and the air-inlet F to its lower end. This enables the section of the air-inlet orifices in F to be diminished by the sleeve, the more the piston diminishes the capacity of the chamber A, and inversely. In this manner, there will always be the same relation between the chamber and the section of the air-inlet orifices.

The patentee claims that, with his burner, "a single injector is sufficient for both low pressure (from 15 to 50 mm.) or high pressure (50 mm. and above). At 50 mm., the injector delivers, for example, 260 litres, and at 15 mm. 150 litres; the capacity of the chamber A being diminished at the same time that the supply of air is diminished. There are thus always three things in constant relation to each other—the supply of gas, the supply of air, and the capacity of the chamber."

Starting Gas-Engines.—Bellamy, A. R., of Stockport. No. 12,045; July 4, 1900.

The object of this invention is to start a gas-engine by pumping into the cylinder (or space behind the piston) a charge of some explosive mixture, and providing means in conjunction with the ordinary igniter, so that the mixture may be exploded at any desired compression and when it is capable of giving the best starting impulse.



The essential feature of the invention consists in the provision of means for firing the charge when sufficient compression of the explosive mixture has been obtained. To effect this, the usual cam G, on the cam shaft H, is provided with a circular boss I, upon which is disposed, before starting the engine, the sliding bowl J of the lever K, which actuates the ignition timing valve F. In this position the rotation of the cam shaft would not affect the lever, and the ignition timing-valve is closed to the igniter A. The force pump B is then actuated by the handle C, forcing the explosive mixture through the nozzle L into the combustion chamber D, as shown by the arrows—the back-pressure valve M preventing the return of the gas to the pump. The requisite number of strokes of the pump-handle to obtain a sufficient compression of the explosive mixture in the combustion chamber is previously ascertained by experiment. When this compression is attained, the lever K is operated by hand to open the ignition-valve to the igniter, so that the charge is exploded and the engine started. At the same time, when the lower half of the lever is raised, the spring N thrusts the sliding bowl J upon the cam G, so that the lever is operated in the usual way by the cam.

To start the engine by hand, without the aid of the pump B, the bowl of the lever K is arranged upon the cam G in its proper working position so as to actuate the ignition timing-valve. The fly-wheel of the engine is then revolved by hand until the engine is started; a valve O being provided to allow the products of the previous explosion in the igniter to escape to the atmosphere. This valve can be closed when required by the screwed spindle P.

APPLICATIONS FOR LETTERS PATENT.

16,077.—Poetter, H., "Gas-generators." Sept. 10.

16,078.—Metropolitan Gas-Meters, Ltd., and Forster, J. D., "Money-boxes, collecting boxes, and the like." Sept. 10.

16,092.—D'Alton, J. J., "Acetylene lamps." Sept. 10.

16,118.—Forsyth, J., "Pipes with special joints for all kinds of liquids and fluids." Sept. 11.

16,171.—Smith, H., "Gas-engines." Sept. 11.

16,194.—Wright, G. E., "Gas heating-stoves." Sept. 12.

16,230.—Hawkins, H. & S. H., "Water-engine." Sept. 12.

16,256.—Gibbons, W. P. & G. B. A., "Regenerative furnaces." Sept. 12.

16,294.—Kerr, H. A., "Chimneys of incandescent gas-burners." Sept. 13.

16,367.—Rees, W. P., and Boundy, G. R., "Generators for the production of acetylene gas." Sept. 14.

16,385.—Hering, A., "Water-motors." Sept. 14.

16,409.—Smyth, J. F., "Manufacturing acetylene gas." Sept. 15.

16,427.—Robertson, G., "Combined shade and controlling and regulating device for gas-lamps." Sept. 15.

16,469.—Smith, G. B. & E. W., "Coin-freed gas-meters." Sept. 15.

16,473.—Pikhart, E., "Incandescent mantles." Sept. 15.

16,598.—Clark, T. E., "Acetylene gas generators." Sept. 18.

16,621.—Bormann, J. G. L., "Gas production." Sept. 18.

16,626.—Welch, W. H. I., "Overhead regenerative gas-lamps." Sept. 18.

16,627.—Abel, C. D., "Gas or oil motors." A communication from La Société Anonyme des Anciens Etablissements Panhard et Levassor. Sept. 18.

16,742.—Cuss, C. T., and Harris, H. W., "Gas generating governor." Sept. 20.

16,780.—Howell, H., "High-pressure accumulator for incandescent gas lighting." Sept. 20.

16,782.—Wernham, W. G., "Gas or water cocks." Sept. 20.

16,825.—Bottomley, J., and Ainsworth, J. T., "Generator for acetylene." Sept. 21.

16,826.—Anderson, A., "Gas-stoves." Sept. 21.

16,829.—Cox, T., "Washing and cleaning street gas-lamps." Sept. 21.

16,889.—Quelch, G. H., and Kent, T. O., "Preparation of carbide of calcium." Sept. 21.

16,902.—Chapman, E. F., and Thornton, H., "Gas-engines." Sept. 22.

CORRESPONDENCE.

[*We are not responsible for the opinions expressed by correspondents.*]

Mr. Forstall's Paper on "Technical Instruction" at the Paris Congress.

SIR,—Owing to the holidays, I have only just seen your report of my remarks in the discussion which followed the above paper, and your editorial comments thereupon.

When stating that the questions for the examinations of the City and Guilds of London were framed with the object of testing the practical knowledge of the candidates, I added (parenthetically) "in my time at any rate." These words do not appear in your report. I attach some importance to them, for the sole and obvious reason that I had no authority to speak for others. Moreover, I only knew clearly what my own aim had been; and I knew also that, in your opinion, as expressed at the time, I had not been unsuccessful in pursuing it.

The case of a successful student who had "never previously set foot inside a gas-works, a laboratory, or even a draughtsman's office," may only serve to indicate how much information is to be derived from the extensive literature on the subject, or from a practical lecturer aided by models and diagrams. Generally speaking, it is not difficult to recognize the mere book student from his answers, which may be rated accordingly. To encourage such candidature can scarcely be called useful work; because success in these examinations can never be of much practical value as the sole qualification of a candidate seeking employment in a gas-works.

Birmingham, Sept. 27, 1900. CHAS. HUNT.

The Allowance to be Made for Fast and Slow Meters.

SIR,—"J. B. P." has a rather curious way of proving his example; but his result is a very telling indictment of the tables referred to. If you will allow me a little more space than my previous letter occupied, I will endeavour concisely to explain the errors which have rightly drawn forth this correspondence.

The term *per cent.* as used in common arithmetic, and commercially, is a catch-word frequently leading into traps. The only safe mathematical remedy is the substitution of vulgar fractions. For instance, a business man will put 15 per cent. on a figure, and then perhaps require to remove it again. This percentage table will not help him, because 15 per cent. off 115 does not bring him back to 100. The right figure is 15 per 115, not per *cent.*, or in fractions $\frac{15}{115}$. The word *cent.* is the culprit. There are a number of such catchwords commonly misused in our language; but it is a serious matter when one of them leads to arithmetical and commercial errors.

Now in testing a gas-meter, one object of registering an error is in order that it may be corrected, presumably on an account rendered. Therefore the error if stated per *cent.* must be per cent. of the meter's wrong reading. Referring to "J. B. P.'s" example:—

Meter . . . 100 cubic feet
Test-holder . 50 ,, ,,

Error . 50 cubic feet fast

That is, 50 per meter reading
= 50 per 100
or in fractions $\frac{50}{100}$

Taking another example:—

Meter . . . 5·00 cubic feet
Test-holder . 6·15 ,, ,,

Error . 1·15 cubic feet slow

That is, 1·15 per meter reading
= 1·15 per 5
or in fractions $\frac{1{\cdot}15}{5} = \frac{23}{100}$
= 23 per cent.

I have before me Mr. F. W. Hartley's book on "Gas Measurement and Gas-Meter Testing," at the end of which is given an abridgment of the tables compiled and printed by order of the Metropolitan Board of Works for the use of their meter inspectors. These are entirely wrong, because they calculate the percentage on the registration of the test-holder instead of the meter, as though the holder were in error and the meter correct. The result is just the same as that pointed out in the letter of your original correspondent "Gas-Meter," although he was wrong as to the source of the error. Therefore his complaint is abundantly justified.

If these tables have been extensively used, then consumers who have had their meters tested and their accounts subsequently adjusted have been either credited too much or debited too little.

I will give two examples:—

(1)
Meter . . . 100 cubic feet
Test-holder . 110 ,, ,,

Error . . 10 cubic feet *slow*.

That is, 10 per meter reading
= $\frac{10}{100}$ = 10 per cent.
Table gives $\frac{9}{110}$ or 9·09 per cent.
(Debit too small)

(2)
Meter . . . 20 cubic feet
Test-holder . 18 ,, ,,

Error . . 2 cubic feet *fast*.

That is, 2 per meter reading
= $\frac{2}{20}$ = $\frac{10}{100}$ = 10 per cent.
Tables give $\frac{2}{18}$ = 11·11 per cent.
(Credit too much)

Really, tables are unnecessary, because the amount passed through a meter in testing is generally either a diviser or a multiple of 100; and the error or difference between the registration of meter and test-holder has only to be multiplied or divided by the same dividend to at once give the percentage.

I do not know whether Mr. Hartley was in any way responsible for the tables referred to; but I had some years ago occasion to consult his book in writing a paper on "The Measurement of Gas," and I then found on pp. 25, 26, and 27 (Third Edition), on rules for corrections for temperature, a hopeless muddle. This was partly owing to his taking his cent., or 100, to represent volumes of gas at a standard temperature, instead of the temperature to be corrected. By the use of vulgar fractions, these three pages may be replaced by a paragraph of about eight lines, which I inserted into the book that was lent me.

With your permission, I will send this and the short table of percentages given on p. 24, with an explanation, for insertion in next week's "JOURNAL," as I think it may be of equal interest to the other matter.

Sept. 28, 1900. B. R. P.

The Production of Water Gas by the Dellwik-Fleischer Process.

SIR,—The article on "Water Gas" in the "JOURNAL" for July 10, p. 85, is very interesting; but these and similar calculations might be much simplified by adopting the method proposed and explained in Hanssen's "Reform of Chemical and Physical Calculations."* By this method, the calculation of this new water gas process would stand thus:

One molecule of water gas $CO + H_2$ consists of—
12 kg. C aerif. at $\frac{14}{15}$ cbm. = 11·2 cbm. aerif. C at 0° N and at atm. density.
16 ,, O at $\frac{7}{10}$,, = 11·2 ,, O } 18 kg. water. ,, ,,
2 ,, H at $\frac{5}{56}$,, = 22·4 ,, H }
30 kg. water gas = 44·8 cbm. water gas of 0° N and ,, ,,
Consequently 1 kg. = $\frac{44{\cdot}8}{30}$ = $\frac{112}{75}$ cbm. ,,
1 cbm. = $\frac{75}{112}$ kg. ,,

The decomposition of 1 kg. of water into O and H gas by heat only, requires 3853⅓ calories; but by the combined action of heat and the chemical affinity of one equivalent of carbon, only $\frac{3853\frac{1}{3}}{2}$ = 1926⅔ calories are required per 1 kg. of water.

To convert 18 kg. of water of ± 0° N, and 12 kg. of solid C into 30 kg. of water gas therefore requires—

Decomposing 18 kg. of water, by heat and chemical affinity, requires 18 × 1926⅔ calories . . . . =	34,680 calories.
In the decomposing process 12 kg. of solid carbon are combined with the 16 kg. of O, set free, forming 28 kg. of CO; and as 1 kg. of solid C produces 2477⅐ calories sensible heat (while 3302⅔ calories become latent in the process of gasifying the solid carbon), it follows that the 12 kg. of solid C produces 12 kg. × 2477⅐ calories = 29,726 calories.	
If the 30 kg. = 44·8 cbm. of water gas leave the generator at 600° N they will carry off 44·8 cbm. × 600° N × $\frac{34}{112}$ calories = 8,160 calories.	
Available heat produced in the converting process =	21,566 ,,
	13,114 calories.
Heat to be supplied by blowing up 1 kg. of solid C burnt to CO_2 produces	11,560 calories.
Gasifying 1 kg. of solid C absorbs two-sevenths of 11,560 calories . . . . . =	3,302⅔ ,,
Sensible heat produced by 1 kg. solid C burnt to CO_2 . . . . . =	8,257⅐ calories.
Products of combustion in air passing off at 600° N 3⅔ kg. CO_2 × $\frac{54}{220}$ cal. × 600° N . . . . . =	570 calories.
$8\frac{8}{9}$ kg. N × $\frac{34}{140}$ cal. × 600° N . . . =	1,296 ,,
	1,866 ,,

Available heat per 1 kg. of solid C burnt to CO_2 = 6,391⅐ calories.
To supply the deficiency of 13,114 calories, must be burnt:

$$\frac{13{,}114 \text{ calories}}{6{,}391\frac{1}{7} \text{ calories}} = 2{\cdot}052 \text{ kg. of solid carbon.}$$

To produce 30 kg. = 44·8 cbm. of water gas consequently are required 12 kg. + 2·052 kg. = 14·052 kg. of solid C. If 1 kg. coke contains 0·95 kg. of solid C and 0·05 kg. of ashes, then 14·052 kg. C are equivalent to 14·80 kg. of coke.

If we estimate leakages, imperfect combustion, radiation of heat = $\frac{14{\cdot}80 \text{ kg.}}{8}$ = 1·85, then 44·8 cbm. of water gas require 16·65 kg. of coke, and 1 kg. of coke produces $\frac{44{\cdot}8 \text{ cbm.}}{16{\cdot}65 \text{ kg.}}$ = 2·70 cbm. of water gas, of 0° N (= 273° N abs.), or $\frac{2{\cdot}70 \text{ cbm.} \times 873° \text{ N abs.}}{273° \text{ N abs.}}$ = 8·63 cbm. if measured at + 600° N = 873° N absolute temperature.

Sept. 24, 1900. C. E.

* See "JOURNAL" for July 27, 1897, p. 217.

Gas Exhibits at the Paris Exhibition.

SIR,—Referring to Mr. Brackenbury's able report on the Paris gas exhibits and to your article on the same, permit me to draw your readers' more particular attention to the very beautiful working model of the setting of inclined retorts, coke conveyor, and automatic coal-store exhibited by the Stettiner-Chamotte-Fabrik.

It may interest English readers to learn that the model is almost an exact reproduction of the new installation recently completed at the Frederiksberg works of the Danish Gas Company, which installation was unfortunately not finished at the time the Institution of Gas Engineers visited the works last year.

The model exhibits to perfection the writer's system of automatic coal

storing and store-emptying arrangements; and, as the mechanism is actuated by clockwork, the motion of the conveyor bands can be seen.

The model, as a whole, is well worth a journey to Paris to see; but the writer will endeavour to procure its exhibition in England at a later date. The original installation at Frederiksberg is always open for inspection.

F. D. MARSHALL.

Copenhagen, Sept. 28, 1900.

Carbon Deposits in Retorts.

SIR,—It was with much interest that I read in your issue of Sept 18 the report of the proceedings at the meeting of the Waverley Association of Gas Managers, and more particularly the discussion with reference to the deposit of carbon in retorts. One point in connection with this was, however, overlooked; that was the high price at present offered for a ton of gas carbon—viz., 45s.

I have given the formation and removal of carbon in retorts a good deal of attention, and agree with most of the speakers that full charges, a light seal in the hydraulic, and regular cleaning and scraping of the retorts, all tend to lessen the growth of carbon deposits.

For the past fifteen years I have carefully kept all the carbon removed from the retorts. I do not burn it off—thinking it is too valuable to burn; and when I have a set of old retorts in use that are to be renewed, I allow the carbon to accumulate and get it off when the retorts are broken up. Sometimes we get the ends of the retorts filled up to the extent of from 6 to 9 inches. This forms a nice heavy lump of carbon for sale. Of course, this is done when the exhauster is off during the summer.

It may be interesting to know that on my works (making 30 million cubic feet of gas) the quantity of carbon produced in fifteen years has been about 8 tons, or a little above ½ ton a year. I do not think this is a large quantity, but would like if someone would compare his output with mine.

Most of the methods referred to for removing the deposit are good. The water spray I have used for 30 years. Some 26 years ago, in England, I sold gas carbon for 20s. per ton. It was used in a foundry where heavy castings were made, and was mixed with the coke.

At present, as gas managers must know, the demand for gas carbon is very great, and prices are high. Hardly a post arrives but there is an inquiry for gas carbon; and for this we have to thank our friend Electricity, who cannot it seems get along without us. Some day in the near future gas may possibly be only a residual, with gas carbon selling at £5 per ton. It might then pay us to produce it, instead of doing, as at present, all we know to prevent its formation.

I may add that the last lot of 4 tons of carbon—the "gatherings" of eight years—I sold for 12s. 6d. per ton; for the next lot I have to sell, I will get 45s. per ton.

The use gas carbon is also put to, I believe, is in connection with the manufacture of calcium carbide.

THOS. D. HALL.

Montrose, Sept. 25, 1900.

LEGAL INTELLIGENCE.

QUEENSTOWN (IRELAND) PETTY SESSIONS.

Monday, Sept. 24.

(*Before Mr.* A. E. HORNE, *Chairman, and a Bench of Justices.*)

Question as to Inspecting a Gas Company's Books.

To-day the Bench were occupied for nearly three hours in dealing with a summons taken out by Major Peter Curry against Mr. James Wilson, the Secretary and Book-keeper of the Queenstown Gas Company, for failing to allow the complainant, as a shareholder in the Company, to inspect the registers of shareholders and transfers and the minute-book and make extracts therefrom. The proceedings were taken under section 119 of the Companies Clauses Consolidation Act, 1845; and it was contended that, by his refusal, the defendant had rendered himself liable to a penalty not exceeding £5.

Mr. T. J. BABINGTON appeared for the complainant; Mr. W. RONAN represented the Company, on behalf of their servant.

Mr. BABINGTON said the Company were incorporated under the above-named Act, but they also had a Private Act. Certain books were directed to be kept, one of which was called the "Register of Shareholders." The capital of the Company was £20,000, of which the complainant and his sister held £3000 in shares and debentures. Major Curry had for a long time been a Director of the Company, and he had reasons for thinking it was necessary that he should look through the books. He accordingly called at the offices, and demanded to see the register of shareholders, the register of transfers, and the minute-book. The last-named book was one in which all the transactions of the Company were entered. There was also the shareholders' list, which was required by Act of Parliament, and defendant refused to produce it. It was necessary for his client to inspect the transfer-books for the purpose of seeing that the purchases of shareholders were entered correctly. The minute-book was an account-book, in so far as it contained an account of every transaction entered into by the Company.

The CHAIRMAN remarked that he had a difficulty in seeing that this was an "account" book.

Mr. BABINGTON said the accounts could not be kept without the minute-book. Moreover, it was one of the books which the Act of Parliament ordered to be produced.

Major *Curry*, examined by Mr. BABINGTON, said he was the owner of shares in the Company. On Friday, the 21st of September, he went to the office and asked Mr. Wilson (the Secretary) for the registers of shareholders and transfers and also the minute-book. Defendant gave him several books to inspect, but refused the three indicated in the summons. He held 100 shares and £1200 of debentures of the Company.

Mr. RONAN remarked that Major Curry was suing Mr. Wilson in his capacity of Secretary and Book-keeper combined. He made his demand under the 117th section of the Act, and prosecuted under the 119th. The former section gave a shareholder the right to see the books; while the latter imposed a penalty for refusing to produce them.

Witness (continuing) said the defendant gave him the ledger, but did not show him the accounts for the past half year.

Mr. RONAN then read the section of the Act which bore upon the case, and asked if a register of shareholders could be called an account-book, and if it came under the section. (To witness:) Did you ever hear of a minute-book being audited by an auditor?

Witness: I did not say so. There is no such thing.

I quite agree with you. Did you ever hear of a register of shareholders being audited by an auditor?—I refuse to answer. I call for protection against such nonsensical questions. I am here to answer any sensible questions that arise.

Did you ever hear of an auditor auditing a register of transfers?—No, I did not.

The ledger was here produced, and the complainant was asked whether he thought the auditor had audited it.

In further cross-examination by Mr. RONAN, defendant admitted that when he was a Director of the Company he never considered whether or not shareholders should be allowed to see the books.

Representatives of the parties having addressed the Court at some length, the Bench retired. On their return after a short consultation,

The CHAIRMAN said that, in their opinion, the refusal to permit the complainant to see the books did not constitute an offence under section 119 of the Act, which would enable them to impose a penalty not exceeding £5. The summons would be dismissed, because the books mentioned therein did not come within the meaning of the section, and were not books required for the purpose of account.

Tampering with a Gas-Meter at Birkenhead.

On Friday, at the Birkenhead Police Court, Edward Orme was charged under section 38 of the Gas-Works Clauses Act, 1871, with fraudulently abstracting gas from a meter, the property of the Birkenhead Corporation. It appears that on the 22nd inst. one of the gas inspectors was passing defendant's house, when he noticed a strong smell of gas. On entering to ascertain the cause, he found that the meter had been disconnected from the service-pipe, and an india-rubber tube had been attached to the outlet from the main, thereby enabling defendant to abstract gas without the supply passing through, or being registered by, the meter. The meter was worked on the penny-in-the-slot system. Defendant told the inspector that they had tampered with the meter because they had not a penny. A Police Inspector stated that defendant had left the town; and his goods had been disposed of. A fine of 40s. and costs, or in default one month's hard labour, was imposed.

Damaging and Pilfering from Prepayment Gas-Meters.

At a recent sitting of the Bench at the Burnley Borough Police Court, Wm. Henry Greenwood was charged with stealing 3s. 1d. from a meter belonging to the Corporation. Mr. Wheatley, the Assistant Town Clerk, was proceeding to prove the charge, when the Magistrates' Clerk said the Bench must first have evidence of the exact sum of money originally in the meter. Mr. Wheatley said it was impossible to prove it. Prisoner was then charged with doing damage to the meter to the extent of 1s. 6d. He denied the offence, and called a witness, who stated that he saw a number of children trying to get pennies out of the meter. There were four previous convictions against Greenwood; and he was sent to prison for one month, with hard labour.

At Warrington on Thursday, Alfred Austin was charged with stealing 4s. from a gas-meter at the house of Robert Dunn. He was further charged with frequenting the same locality on Wednesday night, with intent to commit a felony. Prisoner pleaded guilty to both charges. It appeared that Austin had been lodging at the prosecutor's house for some months, during which time he had taken the lock off the slot meter, and had abstracted the contents. The theft was not discovered until he was found in another house trying to take the money from the gas meter. The lock had been removed from prosecutor's meter; and it was only fastened by a piece of wire. Prisoner was committed to gaol for three months, with hard labour, on each charge.

A Stealer of Gas at Morecambe Properly Punished.

At the Lancaster County Police Court on the 8th ult., Eliza Clegg, of Morecambe, did not answer a summons for fraudulently obtaining gas in the town on Aug. 23. But Mr. J. E. Oglethorpe, who prosecuted, said the defendant was charged with fraudulently introducing a pipe for the purpose of stealing gas from the Gas Company's mains. Mrs. Clegg was a consumer up to March 1, and then notice was given that, if she did not pay a bill of £4 16s. 7d., the gas would be cut off. This was done on March 23 by means of putting a cork in the meters. The meters then stood at 31,600 cubic feet for illuminating purposes and 54,000 cubic feet for cooking purposes. On June 25 there was suspicion that the gas was still being used, and an examination showed that, while there was no change in the illuminating meter, the cooking meter had advanced to 64,700 cubic feet, or 10,700 feet more than in March. The Company's Manager then ordered the meters to be taken out altogether, and the ends of the pipes were properly made up with caps and the taps turned off. On Aug. 23 suspicion was again aroused; and the Chief Inspector watched the house, and applied for admission to inspect it. Mrs. Clegg refused permission, but when the man was in the cellar adjoining, he heard somebody working at the pipe in Mrs. Clegg's cellar. He managed to get into the house, and in the cellar found a strong smell of gas and Mrs. Clegg trying to screw up the tap to the supply pipe. The gas-oven was perfectly hot and some chops were half-cooked. A warrant was granted after hearing evidence. This resulted in Mrs. Clegg putting in an appearance last Saturday week, when a fine of £10 and costs was imposed, or two months' hard labour.

At a special meeting of the Carmarthen Town Council last Tuesday, the tender of Mr. Edward Powell, of Pontypridd, for the construction of a new water reservoir was accepted. The figure was £20,330.

PREPAYMENT METERS.

CHANGING PRICE.
MOST SIMPLE.
NO WHEELS OR PARTS REQUIRED.

THIS METER CAN BE ALTERED *in situ.*

INSTRUCTIONS.

The Brass Plate has holes around its edge, numbered; these indicate the feet delivered for the Coin used To set the Meter, note Figs. I., II., III., IV.

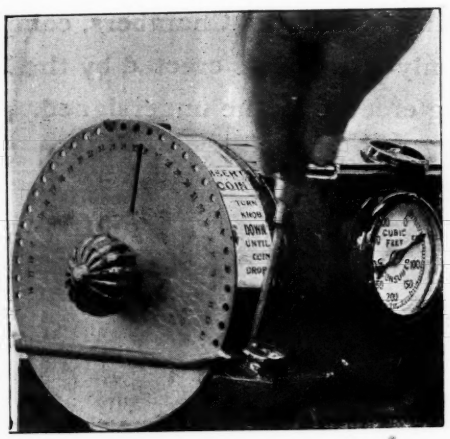


Fig. I.
Break Company's Seal and Remove Screw—THUS.

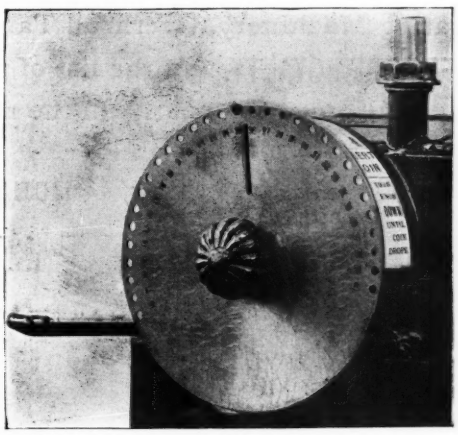


Fig. II.
Swing Band Back—THUS.

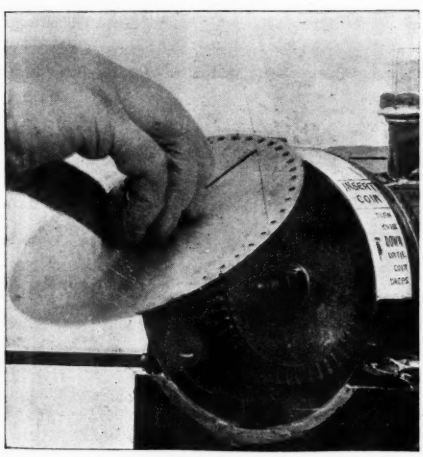


Fig. III.
Lift Plate Off—THUS.

Fig. IV.
Replace Plate—THUS.

Swing Band Forward—Replace Screw—and Re-seal.

NOTHING SO EASY. NOTHING SO ACCURATE.

THOMAS GLOVER & CO., LTD.,

GAS-METER MANUFACTURERS,

214 TO 222, ST. JOHN STREET, CLERKENWELL GREEN, LONDON, E.C.

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28, BATH STREET.
Telegraphic Address: "*GOTHIC.*"
Telephone No. 1005.

BIRMINGHAM:
1, OOZELLS STREET.
Telegraphic Address: "*GOTHIC.*"

MANCHESTER:
37, BLACKFRIARS STREET.
Telegraphic Address: "*GOTHIC.*"
Telephone No. 3898.

GLASGOW:
69-71, McALPINE STREET.
Telegraphic Address: "*GASMAIN.*"
Telephone No. 6107.

A "NEEDFUL" EXPLANATION.

We note an Advertisement in the "JOURNAL," under the name of the NEW CONVEYOR COMPANY, stating that they had taken over the business of the AUTOMATIC COAL-GAS RETORT COMPANY, LIMITED; and, as it may create a false impression, we beg to say there are **NO VALID PATENTS** existing in connection with Inclined Retorts (beyond a few small and subsidiary ones, dealing with details).

We are prepared to erect Inclined Retort Plants, with Conveying and Elevating Machinery, Overhead Tanks, Hoppers, and Measuring Chambers, complete and **FREE OF ROYALTY.** In the list of places given, only a few were erected by the New Conveyor Company—nearly all the remainder being erected by the undersigned.

JONAS DRAKE & SON, OVENDEN, HALIFAX.

GRAHAM, MORTON, & CO., LIMITED, LEEDS.

W. J. JENKINS & CO., LIMITED, RETFORD.

WINSTANLEY COMPANY, COVENTRY.

BRADDOCK'S NEW PATENT

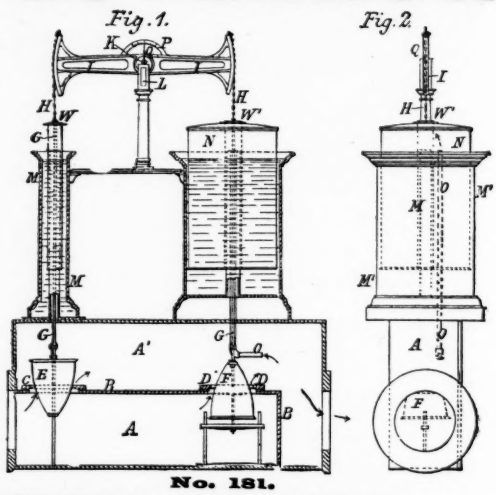
GAS STATION GOVERNOR

GIVES A STEADY OUTLET PRESSURE UNDER ALL CONDITIONS AND AT ALL TIMES.

OVER 80 (4 in. to 36 in. inclusive) SUPPLIED.

THE BEST GOVERNOR OBTAINABLE.

Most compact and convenient.
Unsurpassed for Durability,
Efficiency, and Reliability.



WHEN THE GOVERNOR IS FITTED WITH

BRADDOCK'S PATENT "SELF-LOADING" APPARATUS

The outlet pressure is automatically and gradually varied, within any predetermined and fixed limits, according to the demand for gas being small or large.

First Cost soon saved. A proved success. Repeat Orders received.

J. & J. BRADDOCK (BRANCH OF METERS LIMITED), Globe Meter Works, OLDHAM,

AND 45 & 47, WESTMINSTER BRIDGE ROAD, LONDON, S.E.

Telegrams: "BRADDOCK, OLDHAM," and "METRIQUE, LONDON."

MISCELLANEOUS NEWS.

COMMERCIAL GAS COMPANY.

The Half-Yearly Report and Accounts.

The following is the report of the Directors of this Company for the half year ending June 30, which, with the accounts for this period, will be presented at the meeting of the proprietors on Thursday:—

The Directors submit the accounts for the half year ended June 30, 1900. The revenue account shows a net profit for the half year of £49,424. This, added to the amount brought forward from the previous half year, makes £49,821 1s. 7d. Deducting therefrom £5592 8s. 2d., for interest on debenture stock and loan, there remains standing to the credit of the net revenue account a balance of £44,228 13s. 5d. available for dividend. The Directors recommend the payment of dividends at the rates of 12¾ per cent. per annum upon the old stock of the Company, and of 9¾ per cent. per annum upon the new stock, both less income-tax. The amount by which the profits of the Company are insufficient to pay the dividends will be taken out of the reserve fund. The Directors have found it necessary to increase the price of gas from 2s. 6d. to 3s. per 1000 cubic feet, as from the taking of the Lady-day indices.

The accounts accompanying the report consist of the usual statements. They show that stock to the amount of £800,355 has been raised out of the total of £830,000 authorized; and that £253,287 has been borrowed out of £300,000 sanctioned. The receipts on capital account amount to £1,053,642 (issues of £13,930 of new stock and £15,000 of debenture stock having been made in the past half year); and there is £46,716 of premium capital—making together £1,100,358. The expenditure on capital account in the past six months (£13,213) comprised £6712 for new and additional buildings, plant, &c.; £1240 for mains and services; £2887 for meters and stoves; and £2293 for "coin" meters and fittings, less £1991 written off for depreciation. The total expenditure to June 30 last amounted to £1,067,544. The balance of £32,814 is carried to the balance-sheet. The reserve fund at the above-named date stood at £43,074, and the insurance fund at £28,652. The balance-sheet shows that the value of the stores in hand at the close of the half year was as follows: Coals, oil, &c., £22,446; coke and breeze, £337; tar, ammoniacal liquor, sulphate of ammonia, &c., £6758; sundries, £17,236—making a total of £46,777. The revenue and profit and loss accounts, together with the statements relating to the manufacturing operations of the Company in the half year, are given below.

REVENUE ACCOUNT.

To Manufacture of gas—				By Sale of gas—			
Coals and Oil, including dues, carriage, unloading and trimming	£101,279	13	5	Common gas, per meter, at 2s. 6d. and 3s. per 1000 cubic feet	£165,315	5	5
Salaries of Engineer and Officers at works	2,412	10	0	Public lighting and under contracts, common gas	10,220	19	2
Wages (carbonizing)	19,338	14	7				£175,566 4 7
Purification, including £3191 8s. 10d. for labour	8,841	6	8	Rental—			
Repair and maintenance of works and plant, materials and labour (less £101 4s. 3d. received for old materials)	18,095	10	0	Meters	£2,555	13	7
			£152,467 14 8	Stoves	2,106	1	9
Distribution of gas—				Automatic meters and fittings	2,836	1	2
Salaries and wages of Officers (including Rental Clerks)	£2,042	8	3				7,497 16 6
Repair, maintenance, and renewal of mains and service-pipes, including labour	3,485	8	3	Residual products—			
Repair and renewal of meters	1,714	15	0	Coke, less £4036 1s. 4d. for labour	£30,723	8	0
" " stoves	2,056	8	8	Breeze, less £542 14s. 3d. for do.	1,866	9	9
" Automatic meters and fittings	1,991	5	7	Tar	8,870	3	9
			11,270 5 9	Ammoniacal liquor and sulphate of ammonia	8,325	9	5
Public lamps—lighting and repairing			2,949 4 8				49,785 10 11
Rents, rates, and taxes			7,753 2 8	Miscellaneous receipts—			
Management—				Rents receivable	£165	18	11
Directors' allowance	£1,250	0	0	Transfer fees	23	5	0
Company's Auditors	75	0	0				189 3 11
Salaries of Secretary, Accountant, and Clerks	1,161	18	10				
Collectors' salaries and commission	1,602	14	11				
Coin meter collection	406	16	10				
Stationery and printing	763	16	2				
General charges	550	19	5				
			5,811 6 2				
Bad debts			618 7 1				
Discount and allowances			1,295 5 4				
Law and Parliamentary charges			1,077 4 6				
Superannuation and allowances			257 18 0				
Official Officers			114 7 1				
			£183,614 15 11				
Balance carried to net revenue account			49,424 0 0				
			£233,038 15 11				£238,038 15 11

PROFIT AND LOSS (NET REVENUE) ACCOUNT.

Interest on debenture stock	£5,381	16	0	Balance on Dec. 31, 1899	£50,854	5	4
Balance of interest on temporary loans	210	12	2	Less dividend for half year ended Dec. 31, 1899, £49,475 12s. 6d.; and amount transferred to reserve fund, £981 11s. 3d.	50,457	3	9
Balance available for dividend carried to balance sheet	44,228	13	5		£397	1	7
				Balance from revenue account	49,424	0	0
	£49,821	1	7		£49,821	1	7

STATEMENT OF GAS MADE, SOLD, &c.

Quantity Made, Meter Register (and estimated).	Quantity Sold.		Total Quantity accounted for.	Number of Public Lamps.
	Public Lights and under Contracts (estimated).	Private Lights (per Meter).		
Thousands.	Thousands.	Thousands.	Thousands.	
1,412,763	63,384	1,234,559	1,319,363	5,544

STATEMENT OF COALS.

Description of Coal.	In Store, Dec. 31, 1899.	Received during the Half Year.	Carbonized during the Half Year.	Used and Sold in Half Year.	In Store, June 30, 1900.
	Tons.	Tons.	Tons.	Tons.	Tons.
Common coal	16,958	90,943¾	87,888¾	745½	19,317½
Cannel	6,977	Nil.	2,963*	521	3,493
	23,935	90,943¾	90,801¾	1,266½	22,810½

* Oil used for oil-gas manufacture, 1,583,088 gallons.

STATEMENT OF RESIDUAL PRODUCTS.

—	In Store, Dec. 31, 1899.	Made during Half Year.	Used in the Half Year.	Sold in the Half Year.	In Store, June 30, 1900.
Coke—tons	6,503	53,801¼	16,030¼	44,174	100
Breeze—tons	1,481	12,653¾	—	12,914¾	1,220
Tar—gallons	471,979	1,170,057	—	1,161,536	480,500
Ammoniacal liquor—butts	11,490	27,204	32,328	—	6,366
Sulphate of Ammonia—tons	403	1,057½	—	1,325½	135

ALLIANCE AND DUBLIN CONSUMERS' GAS COMPANY.

The Half-Yearly Accounts.

The accounts which were presented to the shareholders of the above-named Company at their half-yearly general meeting yesterday, showed that in the six months ending the 30th of June no less a sum than £34,114 was expended on capital account. Of this, £16,670 was for manufacturing plant, machines, storage works, &c., £3575 for new mains and services, £2379 for additional meters (£1690 for prepayment meters), and £10,772 for automatic cookers, &c.; bringing up the total expenditure to £1,040,182. As the total amount of capital called up is only £999,906, the account has been overdrawn by £40,276. The Company, however, have £236,000 of unissued capital, and borrowing powers to the extent of £64,000 unexercised. The sale of gas in the half year produced £112,146; the rental of ordinary meters, £3212; do. of coin-meters, £4613; and the sale of residual products, £30,699—the total revenue being £151,109. The expenditure on the manufacture of gas came to £85,030 (coal costing £39,166, and cannel and oil £22,409); on distribution, to £10,449; and on management, to £5047—the total expenses being £111,949. The balance carried to the profit and loss account was therefore £39,160. The amount available for distribution was £40,620; and out of this, dividends at the rates of 10½ and 7½ per cent. per annum on the respective shares were recommended, the payment of which would leave £7342 to be carried forward. The statements relating to the manufacturing operations of the Company showed that 59,210 tons of coal, 9143 tons of cannel, and 459,844 gallons of oil were employed as raw material for the production of gas, of which 780,114,000 cubic feet were made, 673,249,000 cubic feet sold (44,522,000 cubic feet for public lighting), and 684,514,000 cubic feet accounted for; the estimated quantities of residual products being: Coke, 83,772 chaldrons; breeze, 8057 chaldrons; tar, 641,531 gallons; and ammoniacal liquor, 1,427,819 gallons.

COLONIAL GAS UNDERTAKINGS.

In the "JOURNAL" for the 18th ult., we reported the proceedings at the last half-yearly meeting of the Australian Gaslight Company. The accounts of a few other Colonial gas undertakings of less importance have lately come to hand; and they may be conveniently noticed together. In the six months ending the 30th of June, the Brisbane Gas Company made a profit which, with the amount brought forward, gave

them a sum of £10,221—enabling them to pay a dividend of 5 per cent. and the tax thereon, and carry over £2876. The revenue from the sale of gas, &c., was £20,962; and the manufacturing expenses, depreciation, &c., came to £11,718. The Maryborough (Queensland) Gas Company had at the end of June a net sum of £1026 standing to the credit of the profit and loss account. The dividend, at the rate of 6 per cent. per annum for the six months, absorbed £771, and left £255 to be carried forward. The Rockhampton (Queensland) Gas Company had in the past half year a gross revenue from the sale of gas 22 per cent. higher than that for the corresponding period of 1899. The Company's electric light undertaking, however, showed a loss of £143. The amount available for distribution was £1687; and out of it dividends at the rates of 7 and 9 per cent. per annum were paid upon the ordinary and preference shares respectively, free of duty.

BRITISH GASLIGHT COMPANY, LIMITED.

The Half-Yearly General Meeting of this Company was held last Wednesday, at the London Offices, No. 11, George Yard, Lombard Street, E.C.—Mr. J. Horsley Palmer in the chair.

The Secretary (Mr. H. B. Chamberlain) read the notice convening the meeting, and also the Directors' report for the six months ending June last. It stated that the balance of profit was £22,370, after deducting the items mentioned hereafter, and adding £244 from the Trowbridge reserve fund—the parliamentary interest at that station not having been realized by this amount. The deductions were: Income-tax £1045, Hull excess profit £2755, Potteries excess profit £691, Hull debenture interest £1006, Norwich debenture interest £910, Potteries debenture interest £383, Trowbridge debenture interest £76—together £6868. In regard to the Hull station, the gas rental had increased by £3605, coke by £5958, tar and tar distilling by £2899, and ammoniacal liquor and sulphate by £283. Coal had cost 12s. 6d. per ton, against 10s. 11d.; while coke had realized 13s. 9d. per ton, as compared with 8s. 9d. The quantity of gas sent out was 501,435,298 cubic feet, against 453,594,611 cubic feet; or an increase of 47,840,687 cubic feet—equal to 10·54 per cent. Of this, 21,425,000 cubic feet was supplied in bulk to the Corporation. The profit realized was £2755 in excess of the parliamentary interest allowed. The sum named would be invested in Consols; making the reserve fund at this station £39,333. At Norwich, the gas rental had increased by £4251, coke by £1509, and tar by £59; but ammoniacal liquor had slightly decreased. Coal had cost 19s. 5d. per ton, against 15s. 3d.; while coke had realized 12s. 7d. per chaldron, as compared with 9s. 2d. The gas sent out was 185,516,000 cubic feet, against 154,727,000 cubic feet—an increase of 30,789,000 cubic feet, or equal to 19·88 per cent. The profit realized was £3755 less than the parliamentary interest. As to the Potteries station, the gas-rental had increased by £1989, and residuals by £1670. Coal had cost 11s. 7d. per ton, against 9s. 1d.; and coke realized 7s. 10d. per ton, compared with 5s. 6d. The gas sent out was 183,616,000 cubic feet, as against 165,109,000 cubic feet, or an increase of 18,507,000 feet, which was equal to 11·20 per cent. The profit realized was £691 in excess of the parliamentary interest. This would be invested in Consols, making the reserve fund at this station £20,226. Respecting the Trowbridge station, the gas-rental had increased by £444, and residuals by £147. Coal had cost 15s. 6d. per ton, as against 13s. 9d., while coke realized 14s. 11d. per ton, compared with 10s. The gas sent out was 27,928,000 cubic feet, against 24,982,274 cubic feet—an increase of 2,945,779 cubic feet—equal to 11·79 per cent. The profit realized was £244 less than the parliamentary interest. This sum would be taken from the reserve fund, which would leave a balance of £2569 to the credit of the account. Concerning the Holywell station, the gas-rental showed a slight decrease; and the residual products a small increase. The profit realized was £406. The total profit, added to the previous balance of profit and loss, amounted to £48,461. From this, the Directors recommended a dividend at the rate of 10 per cent. per annum, clear of income-tax. This would amount to £21,000, and leave a balance of £27,461.

The Chairman said it was his duty to move the adoption of the report and accounts; and, in doing so, he would make a few remarks on the proceedings of the half year. He thought the Directors might fairly congratulate the shareholders on the state of the accounts. It would be seen that the balance of profit was, as nearly as possible, £1000 more than in the corresponding half of 1899; and this had been arrived at, he might say, without having increased the price of gas at any one of the stations up to the 30th of June last. The Directors had, however, since that date, been obliged to advance the price in consequence of the much higher price they were now paying for coal. But though the additional profit had been obtained without increasing the price of gas, they had, to a certain extent, but not fully, felt the effect of the price of coal. At Norwich, it had hit them rather harder than at any other station, because they had very considerable contracts running under old prices at Hull, the Potteries, and Trowbridge; and, therefore, at those stations, they did not feel so much the effect of the great rise in the price of coal during the half year under review. It would be remembered that at the last meeting, he spoke about the Bill the Company had before Parliament in connection with the Potteries station; and he then told the shareholders that at the last moment, when the Directors thought there would be no opposition, the Corporation of Hanley decided to oppose. They carried on the opposition until the very last possible moment; and it was not until the evening before the Bill was going before Committee, and when the Company had incurred all the heavy expenses of feeing Counsel, witnesses, and preparing the whole of their case, that representatives of the Corporation came and told them that they were not going to oppose if the Directors would give them some slight advantages. So slight were the advantages, that the Board agreed that they would grant them, and so the matter ended. But an amount of nearly £1200 had been expended by the Company in consequence of the action of the Corporation. However, the Company obtained all they wanted in their Bill. They had secured a very valuable property at the Potteries (which was scheduled in the Act), adjoining the North Staffordshire Railway, from whence they would be able to make an excellent siding. Already they had begun to lay out the land for the extension of the present works, which was very much required. The shareholders would probably remember that he also spoke on the last occasion about the works that were being carried out at Hull, in consequence of the Company having been asked by the Corporation of Kingston-upon-Hull to light the area which they purchased from the old Company serving that district. The Company commenced to send gas into the old town the last week of March; and from then they had been giving an ample supply to light the whole of Kingston-upon-Hull. To enable them to do this, they had been obliged to spend large sums of capital at the Hull station. Additional land had to be purchased; the mains had to be increased to a large extent; and a very fine holder had to be built. Nearly all this work had been satisfactorily completed during the spring and summer; and the new holder was almost finished, and would be in action by the first week in November. The new trunk main was completed; and carburetted water-gas plant and new purifiers nearly so. Thus their work there was well in hand; and everything had been done in the most perfect and satisfactory manner. The same remarks applied to the smaller station of Trowbridge, where, in consequence of the increase in the business, they had been obliged to remodel the small works which had been in operation a great number of years, and sadly wanted restoring. They had put up a new gasholder there; and new offices had been built. The holder had recently been tested, was found in perfect order, and had been passed by the Inspecting Engineer. Generally, the whole of the works were ready to meet the winter requirements. This brought him to the point of additional capital. Of course, the new works he had been mentioning at Hull, the Potteries, and Trowbridge had necessitated a very large outlay of capital. Roughly, the total amount which had been, and which would be, spent at these three stations would be something approaching £100,000. It would be remembered that the Board issued, or rather offered, to the shareholders 1500 shares at the price of £40. He believed it was thought at the time they were issued that the Directors were opening their mouths rather wide; but he thought that, in face of the balance-sheet which was before the shareholders that day, the Directors were fully justified in asking £40 for the shares, seeing the excellent business they had in hand, and how well the Company had always paid the shareholders in the past. However, the shareholders did not respond in the way in which the Directors would have liked them to have done, considering what an excellent 5 per cent. investment they put before them. Out of 1500 shares, only about 1100 were applied for by the shareholders; but he need hardly say that, when the balance was offered to the general public, it was most readily taken up. The reason why he mentioned this was that the 1500 shares at £40 only produced £60,000; and whereas, as he had already stated, the amount of capital which they would have to spend on new works, or had expended, was nearly £100,000, there was still some £40,000 to be provided. They now proposed to issue a further 500 shares. They were not, however, going to send out the usual circular, because they had nearly 1500 shareholders, and, for such a small issue as 500 shares, this was hardly worth while. But he should like it to go out to the shareholders in his speech that, if they chose to send in an application at once to the Secretary for any further number of shares, it would meet with due consideration from the Directors. The Directors had full power to issue these shares in any form they liked, either to the shareholders or general public, or both. There was one other subject which he must touch upon. In their report the Directors recorded the retirement from the Board of Mr. Frederic Lane Linging. They had found him for a great number of years—firstly, as Secretary, and afterwards as Director—a very valuable coadjutor; and it was with the greatest feelings of regret that he (the Chairman) noted his absence from the Board that day. Mr. Linging left them shortly after the last meeting, feeling his health was quite broken down, and that he could do no more work. He was most punctilious in his attendance at meetings, and in the way in which he performed his work. As his bodily infirmity would not allow him to continue such close application to business, he felt it was his duty to retire. He (the Chairman) need hardly say that he would be pleased to have a vote from the shareholders, expressing their regret at Mr. Linging's retirement, and hoping that he would live some time longer to enjoy his leisure. They had elected in his place a gentleman known to most of the shareholders, and well known in the gas world. He referred to Mr. R. S. Gardiner, who brought to the Board a great experience in gas affairs, and particularly in matters connected with collieries and coal.

Colonel J. Wilkinson seconded the motion.

Replying to Mr. J. B. Coulson, the Chairman mentioned that the 500 shares would be issued at the same price as last time—viz., £40.

The motion was unanimously carried.

On the proposition of the Chairman, seconded by Major-General W. T. Corrie, a dividend at the rate of 20s. per share for the half year was declared, clear of income-tax.

The Chairman next moved, and Mr. F. Wilkin seconded, the re-election of Colonel Wilkinson and Major-General Corrie as Directors.

The motion having been unanimously carried, the retiring Auditor (Mr. E. Yardley) was re-appointed.

Moved by Mr. Harris, and seconded by Mr. Coulson, a resolution was passed heartily thanking the Chairman and Directors for their attention to the interests of the Company.

The Chairman, in responding, said the Directors were exceedingly glad there had been no feeling caused at any of their stations through the increase in the price of gas—nothing approaching the "remarks" made on the subject in London.

Mr. Harris proposed—"That the shareholders sincerely regret the loss of the services of Mr. Frederic Lane Linging, who, for the long period of over 40 years, has rendered valuable aid to the Company both in the capacity of Secretary and Director."

The Chairman seconded the proposition, which was unanimously passed.

The thanks of the shareholders were accorded to the Secretary and other officials; and an acknowledgment by the Secretary, on his own and his brother officers' behalf, concluded the proceedings.

New offices have been constructed for the Heywood and Middleton Water Board, at Heywood, at a cost of £3800. They were opened last Thursday by Mr. J. Aspell, the Chairman of the Board, who was presented with a gold key by Mr. James Diggle, the Borough Engineer of Heywood.

SHREWSBURY GAS COMPANY.

The Ordinary General Meeting of this Company was held at the Offices, Shrewsbury, last Wednesday—Mr. W. Beacall, the Deputy-Chairman (in the absence of Mr. J. Spencer Phillips, the Chairman) presiding.

The Secretary and Manager (Mr. W. Belton) having read the notice convening the meeting, the report of the Directors and the statement of accounts for the year ending June 30 were taken as read. In their report, the Directors set forth that there had been an increase of 7 per cent. in the consumption of gas during the year, and that the growing demand had rendered necessary some temporary extensions of the works, which were nearly completed. In order to meet further requirements, application would have to be made to Parliament for additional financial powers. In the course of the year, 498 slot meters had been fixed, and 283 cooking and heating stoves let on hire. The accounts showed that the profit realized had been £5275. An interim dividend was paid in March; and the Directors recommended the declaration of the authorized dividend. After providing for this, and for interest on mortgages, there would be a balance of £301 to carry forward.

The Chairman, in moving the adoption of the report, alluded first to the absence of Mr. Phillips, which would, he knew, be deeply regretted by the shareholders, and then referred to a few salient features in the work of the year. He pointed out that the profit has been £5276, against £5136 for the preceding year—an advance of £140. But he said it must be borne in mind that it had not been quite plain sailing. The Company had had two very heavy charges on the revenue. Coals, for instance, had cost £1969 more, partly through the increase of 1s. 6d. per ton and partly from the additional quantity used. Repairs and renewals came to £1364 more; but this included £1200 paid off the suspense account, which was now closed. With regard to the receipts, the Company were in the gratifying position of having an increase of £1654 for gas and of £1555 for residuals; making a total of £3209 from these two sources. The rise in residuals resulted from the increased value of coke, which naturally followed on the enhanced price of coal. The augmentation in the consumption of gas for the twelve months had been more than 10 million cubic feet. This astonishing increase was no doubt due in some measure to the widening of the area of distribution, and to the extended use of gas-stoves and slot meters. There were on hire 1288 of these meters and 521 cooking and heating stoves; and probably there were gas-stoves in use to three times this number in the borough. It was pretty clear that the public were awakening to the fact that cooking by gas was a cleanly, handy, and economical process, and that slot meters were a very great convenience to the smaller consumers. With a growing business, they had to get increased sources of supply, and this meant additional expenditure of money. Some steps would have to be taken to provide fresh capital; and the proprietors would be invited to consider the advisability of raising it. So far as the works were concerned, they were in very admirable order; and, altogether, he thought the Directors might congratulate the shareholders on possessing a very sound, prosperous, and advancing undertaking.

Dr. E. Calvert seconded the motion; and it was carried unanimously.

A dividend was then declared at the rate of 7½ per cent. per annum; the retiring Directors and Auditor were re-elected; and the usual complimentary votes were passed to the Chairman and Directors.

Dr. Calvert proposed a vote of thanks to the Secretary and Manager and the officers of the Company. He said he could assure the proprietors that if it had not been for Mr. Belton they would have found themselves very often, and probably might now have been, in a "tight place." Anyone who was present during the inquiry as to the damage done by the Corporation in respect to the mains would admit that the lucidity and order with which everything was presented, and the way in which their Counsel were instructed, was beyond all praise.

Mr. Wade seconded the motion, and it was carried with acclamation.

Mr. Belton, in reply, said he and the other officers took great interest—as they ought to do—in the affairs of the Company, and did their best to make it successful.

The proceedings then terminated.

OTTOMAN GAS COMPANY, LIMITED.

The Half-Yearly Meeting of this Company was held last Tuesday, at the London Offices, No. 9, Queen Street Place, E.C.—Colonel James Le Geyt Daniell in the chair.

The Secretary (Mr. T. Guyatt) read the notice calling the meeting; and the report and accounts having been taken as read,

The Chairman moved their adoption. In the course of his remarks, he said that, when the Directors had the pleasure of meeting the shareholders on the last occasion, he adverted to the possibility of obtaining an extension of their concession from forty to seventy years; and some additional reference to this matter might be expected. He had, however, nothing further to report. Negotiations in such affairs as this made very slow progress; but their agent on the other side expressed great confidence in the course the negotiations had taken. It would be observed that, in the accounts, they still kept the forty years' concession (which, by the way, did not begin until 1902) as the basis for the calculation of the sinking fund; and if the Company were lucky enough to get a further extension to seventy years, then would be time enough to alter that basis. In the meantime, they must rest satisfied with what they had secured. There was a very important point in the report, and one upon which, he thought, they might all congratulate themselves, and that was the renewal for six-and-a-half years, from May last, of the public lighting contract in Smyrna. This question had given some anxiety to the Board; and it was a matter for congratulation that their efforts, and those of their Manager (Mr. John Gandon), had been rewarded with success. The renewal of the contract had been accompanied by a condition of the Municipality for a certain number (286) of new lamps. Of course, this meant new mains and additional expenditure; but, as a result, it left them in peace and free of trouble from people wanting concessions for electric lighting. In addition to this, it was pleasing to report an all-round improvement in the operations of the Company during the six months, although this had been accompanied by an increase of expenditure; but it was an expenditure that those who understood the working of a business of this kind were quite prepared to face. It was also encouraging to see on the other side of the account what the consumption of gas had amounted to; the whole increase being derived from private consumers as distinguished from public lighting. The report mentioned the election of Mr. Strachan C. Clarke to a seat at the Board. When the services of his brother were required on the embodiment of his regiment (by the way, he was described in the report as "Mr." Stephenson R. Clarke, while the Army List claimed him as a Major), he at once tendered his resignation; but the Directors conceived it would be against the interests of the Company to accept it. Under the circumstances, as they required a certain number of working Directors, and seeing the large stake that Mr. Clarke and his family held in the Company, and their long connection with it, it was considered expedient to elect his brother to the vacancy on the Board which had existed since the loss of their late Chairman. He thought this was an arrangement which would commend itself to the shareholders. Turning to the balance-sheet, the Chairman pointed out the chief items. Among the most interesting, he said an item "Ottoman Government £549" was the accumulation of the Government's 5 per cent. on the profits of the Company. This, however, was not actually paid them, as they generally had an account due to the Company. Bills payable amounted to £2927, which was accounted for by the stocks on the other side of the account. The total balance of profit was £3366. Their investment on plant, &c., now stood at £93,913, which was an addition during the six months of £897. In anticipation of the public lighting contract, they had to commence laying mains; and this was purely on that account. Sundry debtors amounted to £8856, the principal details of which were: Consumers £4099, coke £715, and public lighting £1590. Then under the head of stocks (which amounted to £10,138), coal represented £5024, as against £1175 last year—the balance being made up of the usual gas-works requisites. The depreciation fund, which was invested in Consols, stood on June 30 at £1663; the amount added since and invested making a total of £2234. As to the revenue account, coal cost £4175, as compared with £3561. Having quoted the differences in the other items on the debtor side, he said the gas-rental amounted to £10,009, of which the private rental contributed £6523, as against £5335. The residual products realized £2652, as against £2053. The profit on fittings, &c., amounted to £578. The result was they had a balance on revenue account of £3273, against which debenture interest (£479) had to be charged, and the 5 per cent. for the Ottoman Government on the half-year's profits. This left them a balance of £2654 of net profit.

Mr. Charles Gandon seconded the motion.

The Chairman, replying to questions, said they had not on this occasion added anything to the reserve fund, which now amounted to £12,000, and was invested in coal and so forth. The addition to the number of Directors had not made any difference in their fees. With regard to the use of local coal, they had experimented with it, and with very satisfactory results; but so far as the cost was concerned, there was not much saving, compared with English coal, of which they had something like £5000 worth on the other side. Their Manager was quite alive to the necessity of economizing on every point.

The motion was unanimously carried.

On the proposition of Mr. R. L. Andrews, seconded by Mr. T. H. Cooke, the election of Mr. Strachan Clarke to the Board was duly confirmed.

It was next moved by the Chairman, seconded by Mr. H. W. Andrews, and carried, that a dividend at the rate of 7 per cent. per annum be paid on both classes of shares.

A vote of thanks was passed to the Secretary, the Manager, and the staff generally; and the untiring services of the Chairman and Directors were likewise acknowledged, on the motion of Mr. R. L. Andrews, seconded by Mr. F. E. Linging.

LEICESTER CORPORATION GAS AND ELECTRIC LIGHTING AND WATER DEPARTMENTS.

The Half-Yearly Financial Statements.

At the Meeting of the Leicester Town Council last Tuesday, the half-yearly accounts of the gas, electricity, and water undertakings were presented.

The Gas Committee reported that the gas accounts showed a net profit of £25,054 for the half year ending the 30th of June last, after paying interest on the capital. Out of the net profit had been paid £5165, being the half-year's amount of sinking fund, and leaving a balance of £19,888. On the electric lighting undertaking, there was a net profit of £1430, after paying interest on the capital of the undertaking. Out of the net profit had been paid £1068, the half-year's sinking fund; leaving a balance of £362. The Committee reported that good progress was being made with the installation of the water-gas plant, as well as with the extension of the electric lighting central station.

Alderman Lennard first moved the adoption of the portion of the report referring to the gas undertaking. He said that, after the statement he made in the Council a short time ago with regard to the increased cost of coal and the unsettled state of the markets generally, he thought the Council would be agreeably surprised to have received a balance-sheet showing the largest profit for any one half year that the department had ever yet given. The total expenditure for the six months had been £95,497, which was an increase of no less than £17,729. But fortunately the receipts had gone up still more; for they had amounted to £135,280, which was an increase of £22,864 on the corresponding period of last year. The receipts for gas figured at £98,343, against only £84,552 in the corresponding half year; being an increase of £13,791. In that account there was no advanced price yet charged; the increase was due entirely to the extra quantity made, delivered, and paid for during the half year. They had had an increased make and delivery in the past six months of more than 107 million cubic feet, or 14½ per cent., which was an extraordinary increase, considering that at the same time they were largely developing the use of the electric light. The coke receipts had been exceedingly good; the amount, less labour and cartage, being £22,124, against £14,881 in the corresponding half year, and £9000 odd in the June half two years ago. There were,

of course, two factors—they having sold 44,198 tons of coke, and having obtained excellent prices for it. Tar and liquor sales were also increased to the amount of £1805, on a turnover of the chemical department of £19,311. These products used to be sold without being worked up; and if this were done now, they would get less by about £10,000 than they did at present. Manufacturing expenses had increased by £14,550, of which coal represented £11,736. This was practically divided between the increased quantity and increased price of coal; the cost being 1s. 6d. per ton advance on the previous year—the higher priced coal not coming into use till July. The wages showed an increase of £1880, partly a rise and partly through increased labour. Repairs and maintenance showed an advance of £1535; and distribution £3621 more. On the whole balance-sheet, there was a gross profit of £39,783, against £34,647, or an increase of £5036. Adding to this amount interest which they had received from other departments, the Council would see that there was a gross profit with which they had to deal of £40,717 for the half year. This was the largest profit, or rate of profit, they had ever had; and it figured out at 8·87 per cent. on the total capital invested. From that amount they had had to pay interest £15,633, and sinking fund £5165; leaving a net surplus of £19,888. This was truly a record half year. Some of the members might wish to know how it was they had got such good results in face of what appeared to be gloomy times. It was due to two or three causes; the large increase of business they had done being the principal. The total turnover on the business was £25,000 extra on the half year; while the capital account was practically stationary. When a department or a business was prosperous, it was a temptation to be a little extravagant; but the Committee had been as careful as they possibly could. The cost of coal during the half year was 12s. 5d. per ton, as compared with 10s. 11d. the year before. In spite of the increased price of coal, they had obtained an increased percentage, but he was afraid he would have a very different tale to tell at the end of the next half year, if he was still the Chairman of the Committee, It was true they had £20,000 in hand while the Finance Committee had only estimated £10,000; but he did not think they would be likely to make very much in the coming half year, because they would carbonize extra coal, which would cost much more. It would be necessary to make a small advance in the price of gas; but a higher price would not be obtained for coke.

Mr. Edwards seconded the motion, which was carried.

Alderman Lennard then moved the adoption of the portion of the report referring to the electric lighting undertaking. He remarked that there was a net profit, after paying interest on the capital, of £1430. Out of this had been paid £1068, the half-year's amount of sinking fund; leaving a balance of £362. The revenue account showed that the expenditure amounted to £3154, against £2423—an increase of £731. The receipts had gone up to a greater extent than the expenditure. They amounted to £6208, as compared with £5040—an increase of £1169 over the previous half year. The current sold showed an increase of £1136; but fuel, wages, and distribution expenses had all gone up. Thus they realized a profit of £3054, against £2616, which was an increase of £438. This did not compare so favourably as the Gas Department; the profit being 8·87 for the Gas Department, against 5·31 for the Electric Department. He could not promise any further reduction in the charge for current, as they were selling it practically at cost price. The Committee had not done so badly. They now had a splendid installation, which had not cost the ratepayers a penny; they had a sinking fund of £6660; and they had reduced the price of current from 6d. to 4d. in five years' working. The capital account was not quite so satisfactory. The Finance Committee did not provide them with all the capital they wanted; and they had had to borrow from their bankers, and pay a fair amount of interest. He should also say that at the present moment some £20,000 or £25,000 of capital was laid out in cables and other things, which were not yet in use.

Mr. Edwards seconded the motion, which was passed.

The Water Committee reported that the net profit, after paying interest on the capital of the undertaking, was £8923. Out of this had been paid £3184, the half-year's amount of sinking fund; leaving a net balance of £5739. The Committee proposed to carry this balance to the credit of the special water fund.

Alderman Wood, moving the adoption of the report, observed that the number of consumers had increased by 11,000 during the year; the number at present on the books being 253,325. Happily the rainfall during the year had so far been larger than last year; but whereas the deficiency last year was 512,795,000 gallons, it was now 626,443,000 gallons, so that they were in a worse position although the rainfall had been larger. The quantity consumed per head was somewhat smaller than last year. They were using 5 million gallons per day, or rather more than the daily inflow.

Mr. Billings seconded the motion.

Mr. Holmes inquired whether, in view of the probable shortage of water, a temporary supply would be provided to meet the necessities of the town.

Alderman Wood said the Committee were taking steps to provide a temporary supply.

The motion was agreed to.

The Quality of the New River Company's Water.—A few months ago, the Public Health Committee of the Hornsey District Council had some special analyses made of the water supplied by the New River Company in Hornsey, owing to a test by the Medical Officer of Health (Dr. Henry Kenwood) falling short of the standard of purity he has adopted for the district. It appears that the water had been affected by disturbance in the working of the mains owing to the fixing of fire hydrants in a neighbouring district. At the meeting of the Council on Monday last week, the Committee reported that they had made application to the Company for the reimbursement of the fees, amounting to £14 3s. 6d., they had paid in connection with this matter, and had received a reply to the effect that the Company could not consent to defray the cost of the analyses. One of the members characterized the act of setting up a standard of their own as foolish, seeing that they could not enforce compliance with it. No steps were taken with the view of obtaining payment of the claim.

GAS AND WATER COMPANIES' STOCK AND SHARE LIST.

Referred to on p. 826.

Issue.	Share	When ex-Dividend.	Dividend or Dividend & Bonus.	NAME.	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment	Issue.	Share.	When ex-Dividend.	Dividend or Dividend & Bonus.	NAME.	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment.
£			p. c.	GAS COMPANIES.			£ s. d.	£			p. c.	GAS COMPANIES.			£ s. d.
590,000	10	Apl. 11	10½	Alliance & Dublin 10 p. c.	18½—19½	..	5 7 8	60,000	5	Sept. 28	7	Ottoman, Ltd. . . .	5—5⅛*	+½	6 7 3
100,000	10	,,	7½	Do. 7 p. c.	13⅜—14½	..	5 3 5	500,000	100	June 1	6	People's Gas } 2nd Mtg. of Chicago } Bonds .	102—106	..	5 13 2
800,000	100	July 2	5	Australian 5 p. c. Deb. .	101—103	..	4 17 1								
200,000	5	May 16	6	Bombay, Ltd. . . .	6—6⅛	..	4 12 4	851,070	10	Apl. 27	7	River Plate Ord. . . .	10⅝—11	..	6 7 3
40,000	5	,,	6	Do. New, £4 paid .	4—4⅛	..	5 6 8	250,000	Stk.	June 28	4	Do. 4 p. c. Deb. .	99—101	..	3 19 8
880,000	Stk.	Aug. 15	12	Brentford Consolidated	245—255	..	4 14 1	250,000	10	Sept. 28	8	San Paulo, Ltd. . . .	11—12*	..	6 13 4
270,000	,,	,,	9	Do. New . . .	177—182	..	4 18 11	135,000	Stk.	Sept. 14	10	Sheffield A.	234—239	..	4 3 8
50,000	,,	,,	5	Do. 5 p. c. Pref. .	140—145	..	3 9 0	209,750	,,	,,	10	Do. B.	234—239	..	4 3 8
159,375	,,	June 14	4	Do. 4 p. c. Deb. .	116—120	..	3 6 8	447,427	,,	,,	10	Do. C.	232—237	..	4 4 5
220,000	Stk.	Sept. 14	10	Brighton & Hove Orig. .	220—230	..	4 6 11	5,641,885	Stk.	Aug. 15	5⅛	South Metrop., 4 p. c. Ord.	128—130	+1	4 2 0
226,820	,,	,,	7	Do. A. Ord. Stk. .	150—160	..	4 7 6	1,520,000	,,	July 12	3	Do. 3 p. c. Deb. . .	94—97	..	3 1 10
1,009,500	Stk.	Aug. 29	5	Bristol, 5 p. c. max. .	117—118	..	4 4 9	380,940	Stk.	May 16	5	Southampton Ord. . .	110—115	..	4 6 11
420,000	20	Sept. 28	10	British	39—41*	..	4 17 7	70,825	,,	July 12	4	Do. 4 p. c. Deb.	117—122	..	3 5 7
50,000	10	Aug. 15	12	Bromley, Ord. 10 p. c. .	24—26	..	4 12 4	120,000	Stk.	Aug. 30	6	Tottenham } A. 5 p.c. and } B. 3½ p.c.	112—117	..	5 2 7
79,000	10	,,	9	Do. 7 p. c. . . .	19—21	..	4 5 8	250,520	,,	,,	4½		80—85	..	5 5 11
500,000	10	May 16	6	Buenos Ayres (New) Ltd.	8⅞—9⅛	..	6 9 9	61,550	,,	June 14	4	Edmonton } 4 p. c. Deb.	111—115	..	3 9 7
220,000	Stk.	June 14	4	Do. 4 p. c. Deb. .	98—100	..	4 0 0	182,380	10	Jan. 12	5	Tuscan, Ltd.	7—8	..	6 5 0
150,000	20	July 12	8½	Cagliari, Ltd. . . .	23—25	..	6 12 0	149,900	10	July 2	5	Do. 5 p. c. Deb. Red.	98—102	..	4 18 0
100,000	10	Sept. 28	8	Cape Town & Dis., Ltd.	13¼—14¼*	+½	5 10 4								
50,000	50	May 2	6	Do. 6 p.c. 1st Mort.	54—56	..	5 7 2								
550,000	Stk.	Apl. 11	13½	Commercial Old Stock .	270—280	..	4 16 5								
236,425	,,	,,	10½	Do. New do. .	205—215	..	4 17 8								
288,237	,,	June 14	4½	Do. 4½ p. c. Deb. .	133—138	..	3 5 3								
800,000	Stk.	May 31	9	Continental Union, Ltd.	167—172	+2	5 4 8					WATER COMPANIES.			
200,000	,,	,,	7	Do. 7 p. c. Pref. .	170—175	..	4 0 0	780,404	Stk.	June 28	11	Chelsea, Ord.	300—305	..	3 12 2
51,600	Stk.	—	14	Croydon A 10 p. c. . .	—	..	—	150,000	,,	,,	5	Do. 5 p. c. Pref. .	155—160	..	3 2 6
178,400	,,	—	11	Do. B 7 p. c. . .	—	..	—	160,000	,,	,,	4½	Do. 4½ p. c. Pref. 75	143—148	..	3 0 10
555,000	Stk.	Aug. 15	5½	Crystal Palace Ord. 5 p. c.	115—120	..	4 7 6	175,785	,,	Sept. 28	4½	Do. 4½ p. c. Deb. .	143—148*	..	3 0 10
60,000	,,	,,	5	Do. 5 p. c. Pref. .	130—135	..	3 14 1	1,720,560	Stk.	Apl. 11	7	East London, Ord. . .	193—198	..	3 10 8
486,090	10	July 27	11	European, Ltd. . . .	19—20	..	5 10 0	654,740	,,	June 14	4½	Do. 4½ p. c. Deb. .	147—152	..	2 19 3
854,060	10	,,	11	Do. £7 10s. paid .	14—15	..	5 10 0	797,687	,,	,,	3	Do. 3 p. c. Deb. .	96—98	..	3 1 3
14,993,075	Stk.	Aug. 15	4 4/5	Gas- } 4 p. c. Ord. . .	98—100	+1	4 8 0	700,000	50	June 14	7½	Grand } 10 p. c. max. .	107—110	..	3 8 2
2,600,000	,,	,,	3½	light } 3½ p. c. max. .	92—94	..	3 14 6	310,000	Stk.	Sept. 28	4	Junction } 4 p. c. Deb. .	130—135*	+2	2 19 3
3,799,735	,,	,,	4	and } 4 p. c. Con. Pref.	114—117	..	3 8 5	708,000	Stk.	Aug. 30	14	Kent	295—305	..	4 11 10
3,993,975	,,	June 14	3	Coke } 3 p. c. Con. Deb.	93—95	..	3 8 2	160,000	,,	,,	7	Do. New, 7 p. c. max. .	200—210	..	3 6 8
70,000	10	May 31	8	Hongkong & China, Ltd.	13½—14½	..	5 10 4	1,043,800	100	June 28	10½	Lambeth, 10 p. c. max. .	287—292	+2	3 11 11
3,800,000	Stk.	May 16	10	Imperial Continental .	207—212	+3	4 14 4	406,200	100	,,	8	Do. 7½ p. c. max. .	205—210	..	3 16 2
473,600	Stk.	Aug. 15	3½	Do. 3½ p. c. Deb. Red.	99—101	..	3 9 4	350,000	Stk.	Sept. 28	4	Do. 4 p. c. Deb. .	127—130*	..	3 1 7
75,000	5	June 14	6	Malta & Medn., Ltd. .	4¾—5¼	+¼	5 14 3	500,000	100	Aug. 15	14	New River, New Shares	410—415	..	3 7 6
560,000	100	Apl. 2	5	Met. of } 5 p. c. Deb.	107—110	..	4 10 11	1,000,000	Stk.	July 27	4	Do. 4 p. c. Deb. .	128—133	..	3 0 2
250,000	100	,,	4½	Melbourne } 4½ p. c. Deb.	106—108	..	4 3 4	902,300	Stk.	June 14	7½	South- } Ord. . . .	194—199	−1	3 15 5
541,920	20	May 31	3½	Monte Video, Ltd. . .	10¾—11¼	..	6 1 8	126,500	100	,,	7½	wark } 7½ p. c. max. .	182—187	..	4 0 3
667,946	Stk.	Aug. 30	9½	Newc'tle & Gatesh'd Con.	210—215	..	4 6 1	489,200	Stk.	,,	5	and } 5 p. c. Pref.	155—160	..	3 2 6
299,855	Stk.	June 28	8½	Do. 8½ p. c. Deb. .	104—107	..	3 5 5	1,019,585	,,	Apl. 11	4	Vauxhall } 4 p. c. A Deb.	129—134	..	2 19 9
150,000	5	May 16	8	Oriental, Ltd. . . .	7⅛—7⅝	..	5 3 8	1,155,066	Stk.	June 14	10	West Middlesex . . .	274—279	..	3 12 2
135,000	5	,,	8	Dc. New, £4 10s. pd.	6—6½	..	5 10 10	200,000	,,	,,	4½	Do. 4½ p. c. Deb. .	140—145	..	3 2 1
15,000	5	,,	8	Do. do. 1879, £1 pd.	1¼—1½	..	4 11 5	200,000	,,	Sept. 14	8	Do. 8 p. c. Deb. .	97—99	..	3 0 7
					*Ex. div.								*Ex div.		

ELECTRIC LIGHTING NOTES.

Last Thursday the General Purposes Committee of the Macclesfield Town Council sat for fully two hours, discussing whether the Council should themselves undertake the introduction of electric light and power or offer facilities to private companies to do so. By 24 votes to 5, it was determined to apply for a Provisional Order.

The Electric Lighting Committee of the Worthing Town Council have accepted offers for plant required in connection with the municipal electric lighting undertaking, amounting to £16,136. The erection of the generating station and the alterations to existing buildings on the site are to be carried out by the Corporation under the supervision of the Borough Surveyor.

The Walker District Council have received a cheque for £1937 from the Electric Supply Company, being the cost of the opposition of the Council to the Gas Company's application for electric lighting powers. There is something about this transaction and the opposition that does not look exactly like fairplay. However, the cheque apparently ends the matter; and the Finance Committee state that it has enabled the Council to reduce the general district rate by 4d. in the pound, and to carry out a certain number of necessary improvements without having to levy a rate for the purpose.

The "Coventry Herald," in one part of a recent issue, says that the figures of the Corporation Electric Lighting Department for the quarter ending June suggest "that the light is making a marked advance in popularity." In another column of the same impression, it is reported that "shortly after eight o'clock on Friday night last, the electric lights throughout the city suddenly failed. The streets were consequently rendered very dark, as there was a heavy mist at the time. . . . The cause of the light failing was the breaking of a governor spring on one of the engines at the generating station. In two minutes, another engine had been set working and the light turned on."

"Coming out of St. James's Church, Piccadilly, into Jermyn Street, after the evening service last night," said the "Daily Express" yesterday, "the congregation received a rude shock. Rumblings were heard as from the bowels of the earth; the electric lights flickered, and were nearly extinguished; and all wondered what was next to happen. In a few seconds there was a terrific explosion, which was followed by clouds of smoke issuing from a manhole. Cab horses bolted, and the people fled in panic. Crowds soon rushed down from the Circus and Regent Street, and were followed closely by half-a-dozen fire-engines and a large force of police from Vine Street. The report of the explosion was heard as far away as Leicester Square and Pall Mall. Workmen soon arrived from the Electric Light Company's depôt in Mason Yard, close by; and in about an hour's time they were enabled to descend the subway." Our contemporary's representative was officially informed that the cause of the explosion was supposed to be the fusion of wires, and that the resulting sparks must have come into contact with either sewer or coal gas.

The Hampton District Council have had submitted to them a report on the electric lighting of the district by Messrs. H. W. Handcock and A. H. Dykes, Consulting Engineers, and Mr. J. Kemp, Surveyor to the Council. It is evident from the report that, like numberless other places in the United Kingdom, the one great thing that is required for Hampton is electric lighting. It would, we read, be "advantageous to the growth and development of the district, owing to the greater purity of the light as compared with gas or oil, and the inducements thereby offered from a sanitary point of view alone for people to come and reside in the district." The wonder is how Hampton has managed to exist and thrive without the electric light so long. But there is no necessity for the town to go on without it now—indeed, it would be positively wicked for the District Council, in view of such sage counsel as has been tendered to them, to neglect the provision of an installation one day more than is absolutely essential. There need be no fear on the score of the success of the concern; for the reporters say that "ultimately" (whenever that may be) the "undertaking will be a great success financially and a valuable asset." As is pointed out, one thing in favour of the Council is that they can annex the whole of the public lighting, which now costs altogether about £912—a comfortable little beginning for the business. Then it is not thought unreasonable that, within a very short time, there would be a total of 1500 16-candle power, or 3000 8-candle power, lamps connected. A refuse destructor is also recommended. The estimated total cost of the scheme is: Electric light station and mains £15,450, and refuse destructor £3425; while the working expenses for the electric light are estimated at £1732 per annum, and for the destructor at £398. The total revenue, including the £912 from public lighting, is placed at £2632. It is also advised that, to gain small consumers, arrangements, should be made with one of the free-wiring companies.

A big expenditure is contemplated in connection with the Buxton District Council electricity works; and the proposal brings to notice that the light has not altogether so far enchanted the residents. At the same time, extensions are required at the works; and these, according to the Electrical Engineer (Mr. Calvert), will entail an expenditure of £25,041. For sanction to the borrowing of this amount, less the odd figures, the Electricity Committee recommended the District Council at their last meeting to apply to the Local Government Board. Then up rose Mr. Hall, who said he did not want to impede the progress of electricity in Buxton; but first of all he wished to see the present system perfect. They had already spent £23,000; and now were asked to spend £25,000 more. He for one would not lay out another farthing until they saw the system they had in hand perfected. He cast no slur on the Electrician; but he was not satisfied with Professor Kennedy. They had not had any income yet from the works; and instead of paying £300 a year for lighting the town, they were spending £500 a year, and even then it was not lighted up to the standard of the gas they had paid for before. Who ought to look after the lamps? Was it Professor Kennedy's duty, or the Electrician's, or his men? Let them have Professor Kennedy down, and talk to him. Things were not going right; and they wanted to call on Professor Kennedy to put them right at once. If they could not be put right, then he should suggest that the lamps be taken down, and others put in. Mr. Hulme said the lamps in the streets were a disgrace; and no more money should be spent until the present system was in order. Mr. Harrison also found fault with the arc lamps. Mr. Salt, the

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LARGE APPARATUS.

HOTELS
AND
INSTITUTIONS.

ENQUIRIES INVITED.

SPECIAL DEPARTMENT.

Chairman of the Committee, said there was no fault to find with the mains. He was sorry that some of the lamps had been out, but they could not help it. Professor Kennedy had written saying that Messrs. Crompton would, he was sure, make a point of getting matters put right with regard to the lamps. He (Mr. Salt) thought they were likely to make a profit of £800 on the present undertaking; and this in face of all their difficulties. An excited discussion followed; and Mr. Hall moved that Messrs. Crompton be given notice, either directly or through Professor Kennedy, that the complaint should be forthwith attended to. Mr. Hulme seconded; and the resolution was adopted.

NEW WATER-WORKS FOR ST. HELENS.

An interesting step in the development of the St. Helens water supply was made last Thursday, when the laying of the foundation stone of the new works at Melling was performed by the Mayor (Mr. J. Beecham).

For years it has been felt that the supply of the town would become dangerously short if a breakdown occurred at any of the stations; and this view was put forward when the Corporation, in 1893, decided to erect the works at Melling. An application was made to the Local Government Board to borrow £75,000 for the purpose; and at the ensuing inquiry, Mr. W. J. Jeeves, who was then Town Clerk, placed statistics before the Local Government Board Inspector. From these, it appeared that in 1871 the population of the town was 45,000; and the consumption of water 283 million gallons. In twenty years the population had increased to 71,000, and the consumption to 1000 million gallons. Instances were given by the Water Engineer of interference with the supply owing to breakdowns. They had sunk a trial bore which gave a supply of 250,000 gallons in twenty-four hours. The estimated expenditure on the pipe-line was: Melling to Kirkby, £5651; Kirkby to Knowsley, £9260; Knowsley to St. Helens, £26,550—leaving £43,539 for land, boreholes, machinery, and buildings. Professor Hull, the geologist, expressed the opinion that the minimum yield of the proposed wells would never be less than 1 million gallons per day, and would possibly go up to 1½ millions. Regarding the new station, Mr. J. J. Lackland, the Borough Water Engineer, is responsible for the design of the new building and the engines. Two boreholes of 560 feet deep have been made by Messrs. Timmins and Sons. The water will be pumped from the wells through an 18-inch main to the 21-inch main at Kirkby, two miles away, and thus on to St. Helens. The pumping-engine is to be of 200-horse power. The work will probably be completed in nine months.

The Mayor and members and officials of the Corporation drove to Melling on Thursday, lunching at the Knowsley pumping-station *en route*. At Melling the company inspected the works so far as they have been completed; and then Mr. Dixon-Nuttall (the Chairman of the Water Committee) called upon the Mayor to lay the stone. This ceremony was duly performed; the Mayor declaring the stone "well and truly laid," amid applause. A handsome chased silver trowel with ivory handle was presented to His Worship for use on this memorable occasion.

NOTES FROM SCOTLAND.

From Our Own Correspondent.

Saturday.

After the holiday season, the Edinburgh and Leith Gas Commissioners entered upon their winter duties on Monday. At their meeting that day, the most interesting and most pleasant item of business was the intimation by the Chairman (Provost Mackie, of Leith) that a letter had been received from Mr. Kinloch Anderson, in which he stated that he expected to be able to be present with them soon. Mr. Kinloch Anderson's restoration to health was hailed with gladness by all present, as it is felt that just now his services are invaluable to the Commission. The report by Mr. W. R. Herring, the Engineer, showed that during the month of August there was an increase of 6,680,000 cubic feet in the output of gas, as compared with the same month of last year; and that since May 16, the increase has been 15,179,000 cubic feet. The recommendation of the Works Committee, that the Commissioners should continue to supply gas of from 24 to 26 candle power, and that the price should be raised from 3s. to 3s. 4d. per 1000 cubic feet, was agreed to without remark. The increased price is to take effect only after the current accounts are rendered—the Commissioners thereby evading trouble with recalcitrant consumers, who object to increases in price being made retrospective. The estimates of income and expenditure for the current year, which were submitted by Mr. J. S. Gibb, the Treasurer, and upon which the increase in price is based, show an expected output of gas of the same quantity as last year, and that, with gas at the same price, and the return from residuals being £34,554, as against £35,928, there would be a deficit on the year's working of £52,100. He estimates the expenditure upon coal at £148,102, as against £103,321; and upon oil at £17,078, as against £9970. The total expenditure is put at £343,878. The increase of 4d. per 1000 cubic feet is only sufficient to make up a little more than half of the deficit. The remainder is to be taken from a working balance which has accumulated from previous years, and which it is expected will then be left with only about £5000 at its credit. The Commissioners are making inquiries for the purchase of about 30,000 tons more of coal. It was reported that the undertaking of the Commissioners had been valued for the year at £70,070, an increase upon the valuation of the past year of £11,430. Next year, according to the peculiar method of fixing valuations, if the expected deficit be realized, the undertaking should be entered, if that were possible, at less than *nil*. Mr. Douglas moved that—"In view of the greatly extended use of coal gas for cooking and heating purposes and for lighting with the incandescent burner, the necessity for continuing to supply gas of a high illuminating power appears to have vanished; and that, with a view of immediately proceeding to reduce the quality of the gas, and thereby lessening the cost of production and its consequent cost to the consumer, the whole matter be remitted to the Works Committee for consideration and report." In support of his motion, he said he thought it desirable that they should bring their gas, as regarded illuminating power, more into harmony with that supplied in other large cities. He had no doubt that gas less rich than they had could be better purified, and was thus much more healthy

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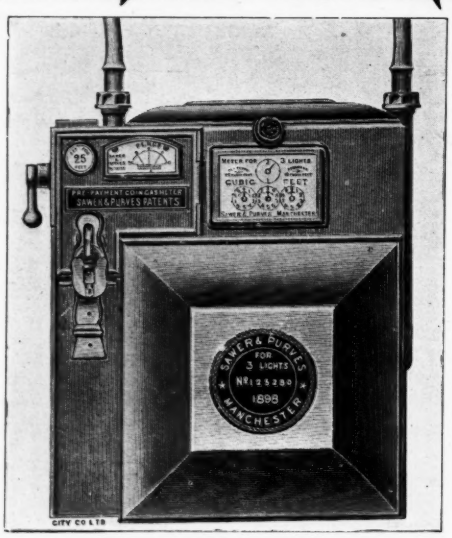

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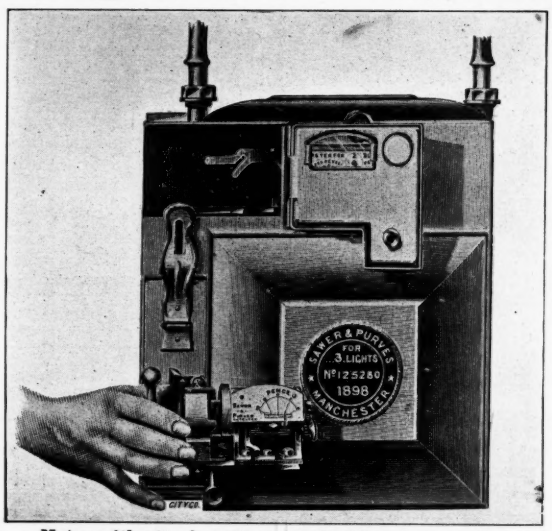

Meter with attachment removed without uncoupling.

to the inmates, and not so deteriorating to the fittings of houses. Bailie Manclark, of Leith, in seconding, said there was now a large consumption of gas in cookers and engines; and he thought it was absolutely necessary that they should reduce the illuminating power. Under their Act of Parliament, they could not reduce it below 20 candles.

The Chairman said there were complaints in Leith as to the bad quality of the gas; and it was desirable that they should do something; otherwise some might give up the use of gas altogether. The suggestion was made that the burners in use in Leith might be to blame for the poor light; but Bailie Manclark resented the remark, and said that the works in Leith were incapable of making the quality of gas in sufficient quantity, no matter what coal was used. Mr. Waterston objected to the phrase, "the necessity for continuing to supply gas of a high illuminating power appears to have vanished." He did not wish to commit himself to any such proposition. He was easily satisfied, and the remit was made; the Chairman remarking that the subject would require to be very carefully gone into by the Committee. I remember that the matter was considered by the Commissioners some years ago; and it was then concluded to be inadvisable to lower the illuminating power, because the mains and services had been laid for a high-quality gas, and if a poorer quality were supplied a great deal of expenditure would be necessary to adapt them for carrying the greater volume which would be required. But much has happened since then; and it is advisable, in the altered circumstances, to reopen the question.

I am obliged to revert to the subject of the legality, or the reverse, of making increases of the price of gas retrospective; for in Dundee this week a "kind" friend, in the shape of an evening newspaper—a good specimen of the mare's nest hunting species—has set the community agog over it, and has succeeded, without doubt, in placing the Gas Committee in a position which is not only awkward, but serious. There have been mutterings all through the summer at the action of the Gas Commissioners in raising the price from 3s. 4d. to 3s. 10d. per 1000 cubic feet; and the discontent gained greatly in volume when it was learned that the increased charge was being made to date back to the February-March survey, and that in the adjacent small town of Broughty Ferry, the Commissioners were able to reduce the price of gas. The storm-cloud which had been gathering burst on Monday, when the newspaper brought out an article intended to "expose" a "gas scandal." The complaint of the writer was that the Gas Department had not only raised the price of the gas, but that they were "granting concessions to some and leaving others to pay the full amount." The meaning of this is that, when it is demanded, some are being allowed a rebate which makes the price of gas 3s. 4d. till June 20, when the annual meeting was held at which the price was increased. One of the questions raised is by whose authority this is being done. Assuming, on the word of the newspaper, that it was being done, it is certain that the step was not taken upon instructions from the Gas Commissioners, for they had never had it before them. Indeed, the Gas Committee are only announced to have had the subject before them on Thursday. As the account of this meeting appears to have been communicated by some official, I give it as it appeared:

A joint meeting of the Finance and Gas Committees of the Dundee Town Council was held yesterday, when consideration was given to the question of surcharging by the Corporation for gas. Treasurer Ritchie, who presided, explained that what had taken place was in accordance with previous practice since the Gas Act came into operation 32 years ago. It was quite true that some persons were charged the higher rate from a period at the end of February or March. This arose from the fact that the meters in the city could not be examined at the same time. It had been the practice to inspect the meters quarterly; and the consequence was that the quarters varied in the case of different consumers. It had been the practice during the last thirty years to charge the gas for the quarter at the price ruling when the reading took place; and taking one year with another, this practice was fair and just, because if the consumer was charged the high rate this year from (say) March, he would get the benefit of the lower rate next year from the same date, and so on every year. The Treasurer further explained that, in order to have the quarter-day the same in every case, the meters would require to be inspected on the same day; and this would entail the employment of 400 or 500 additional men. Therefore he could not believe, if the public understood the matter correctly, there would be the slightest objection to following the course which had been taken in this, as in previous years. The Treasurer further stated that, about 1886, when the rate was raised, some eight or nine people started the same complaint as had now been publicly ventilated. The consequence was that it was arranged to read their meters at the end of the financial year—namely, April 30. But these people soon got tired of this arrangement; and, in accordance with their request, the customary practice was followed. Nobody doubted, or had ever raised the question of, the Gas Commissioners' powers in regard to applying the new rate to the past financial year. It had never been alleged that it was exactly in terms of the Act; but for the reasons already stated, it was the most convenient course to follow, and from one year to another nobody was any the worse. The Clerk was asked to give his opinion on the legal question. He stated that the higher rate could not be charged for any period anterior to the beginning of the financial year; but that the higher rate ought to be charged, and could be enforced, from and after the beginning of the financial year—that was, from and after April 30 last. He explained that, in 1868, the financial year of the Gas Commissioners was made to end on April 30, and this had been followed yearly ever since. He added that, by section 90 of the Commissioners Clauses Act, which, though incorporated by the original Gas Act of 1868, seemed to have been lost sight of by the critics of the Town Council, it was enacted that the Commissioners "shall cause their accounts to be balanced in each year at a period not less than one month before the annual general meeting at which they are to be produced." Now, this annual meeting was fixed by the original Gas Act on the second Tuesday of June (since altered by the Amending Act to the third Wednesday of June) in each year. Accordingly, the Legislature created the financial year of the Commissioners. The wording of section 69 of the original Act, which the Clerk showed had been published in the newspapers, must, he said, be read as following and carrying out the provisions of section 90 of the Commissioners Clauses Act, which is incorporated in the original Act in one of its earlier sections. Section 69, therefore, when it mentioned the "year," referred to the financial year of section 90, and to nothing else. This was evidenced by the provision at the end of section 69 itself—viz., "Provided always that if in any year the revenue received exceeds the amount required for the purposes aforesaid, the Commissioners shall make such reductions in the sums to be charged by them in the following year for the like reasons, or one or more of them, or carry such surplus to the sinking

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fund hereinafter provided, as they shall think proper." The "year" here referred to could be no other than the financial year, because one balance could only be made in each year, and a balance could alone show any excess of revenue; and the balance must be made not less than one month before the annual general meeting. He added that the idea of dating the new rate, whether higher or lower, as from the annual general meeting, and not from the end of the financial year, April 30, was a delusion. He explained that there was nothing unusual in fixing rates retrospectively to the beginning of the financial year. The gas-rate was fixed this year from May 1, the day following the end of the financial year; and it had always been so. It was advertised on the 21st of June, the day after the annual general meeting, and was so fixed for the year. The public, the Clerk added, were duly notified; and nobody appealed or complained. Further, the police assessments ran from May 15; but they were never laid on until the September following. The water-rates also ran from May 15; but they are never laid on until the general meeting in July following. And so with all other assessments. The meeting, after consideration, were of opinion that use and wont should be followed, and that if parties claimed rebates to April 30 they should be allowed; but care should be taken that next year, or in any following year, when most likely the gas-rates would be reduced, the higher rates should be exacted from such parties claiming rebate down to April 30.

Now, I think that, notwithstanding the Clerk's (Sir Thomas Thornton) opinion, there can be no doubt as to the illegality of the practice of going back even to the date of the annual meeting, because in the portion of section 69 which Sir Thomas did not quote, the power to alter the price of gas is given for "the year then ensuing." But whether the action of the Commissioners was legal or not, they have been placed in a false position—first, by their resolving to give rebates to cover the period to April 30; and, secondly, by, in practice, giving rebate to June 20. My authority that they are doing the latter is the same newspaper; and I assume it to be the case. But whether it is so or not, it is amazing that the Commissioners should, at this meeting, have come to the conclusion that they would take the names of those claiming rebate, and would not give them the benefit of any reduction until the expiry of the financial year. This is not a worthy policy for a great corporation. These outlanders will give more trouble than the amount which may be obtained from them, as intended, can be worth. I know that it is easy to write thus, and that it is exceedingly difficult to find a remedy. Money must be secured for the carrying on of the gas undertaking; and the way to raise it is by charging for the gas which is consumed a price which can be adjusted to suit circumstances. The price has been adjusted in Dundee; and if it cannot be recovered, it will not be possible to meet other circumstances which are inexorable. It is a situation which cannot be looked upon without sorrow; for what is transpiring is only the outward manifestation of a distrust of public men which is felt. If this distrust be warranted, it will be hopeless to expect that public affairs in Dundee will be conducted on prosperous lines until able men are found willing to undertake the duties of municipal life. If it be not warranted, there can be small credit to anyone who endeavours to throw trouble in the way of those who attend to the communal interests. But whether warranted or not, the withholding of the increased rate is a poor remedy. If the action of the gas consumers should result in a deficit, the high price will have to be continued another year, or a still higher price put on. The community will have to meet the charges; and an error in the method of imposing the rates to meet those charges is only a matter of detail. The only people who can be aggrieved by it are those who may leave the city before the reduction takes place. This must be a small number; and if such cases were to be considered, public business would come to a standstill. Though it may not be strictly legal, the practice of making increases in price retrospective is no more unjust than is that of taking a whole year's assessment for (say) police purposes, from a person who may live in the place for a month or two. Yet we never hear of an emigrant demanding back a proportion of his rates on the ground that he was leaving the country. The one would be as reasonable as the other. This being so, the action of the newspaper, and of those who have been moved by it, is not to be commended. The pity is that, the Commissioners having adopted a policy, they have not stuck to it.

The motion, of which notice was given by Bailie Fife in the Glasgow Town Council in August, relating to the purchase or lease, by the Corporation, of coal pits, was before the Council on Thursday. Bailie Fife said he did not advocate the proposal on socialistic principles, but purely as a commercial transaction. The amount of coal consumed by the Gas Department had risen from 516,315 tons in May, 1896, to 666,769 tons in the year ended May 31, and the price had advanced in the same period from 9s. 2·85d. to 11s. 5·44d. The estimate for the year that would finish in May next was about 700,000 tons; and the price was 16s. 2d. per ton. The average price for the five years was 9s. 11d. per ton. On the ground of the increased cost of coal, as well as of the profitable business that the Corporation could make of it, he advocated the motion. Bailie Shearer moved the previous question. Bailie Fife, he said, was putting before the Council a most pernicious principle, and one very dangerous to the best interests of the Corporation. He believed the Council or the country should take up any work that was a monopoly—such as tramways, gas, and water—but coal was no monopoly. The rise in the price of coal was merely temporary. Mr. R. M. Mitchell, the Convener of the Gas Committee, did not think it was fair to speak of the coal trade as a monopoly. It was no more a monopoly than any other trade. As regarded the resolution, he pointed out that it was not the purchasing or leasing of land with coal mines merely that would require consideration; and he thought it would be a mistake for the Council to embark hastily in a thing that might prove later on to be a very gigantic undertaking. The subject was, by 29 to 26 votes, sent to the Gas Committee to consider. By the time the Committee come to a decision upon it, the price of coal will be down, and the scheme, which is a somewhat Utopian one, will in all probability be dropped.

The Water Scheme for Longtown.—The new scheme which has been prepared by Mr. Little, of Carlisle, for the supply of Longtown, in Cumberland, with water, was approved at the meeting of the District Council last Tuesday. The cost is estimated at £17,000; and application is to be made to the Local Government Board for power to borrow this amount.

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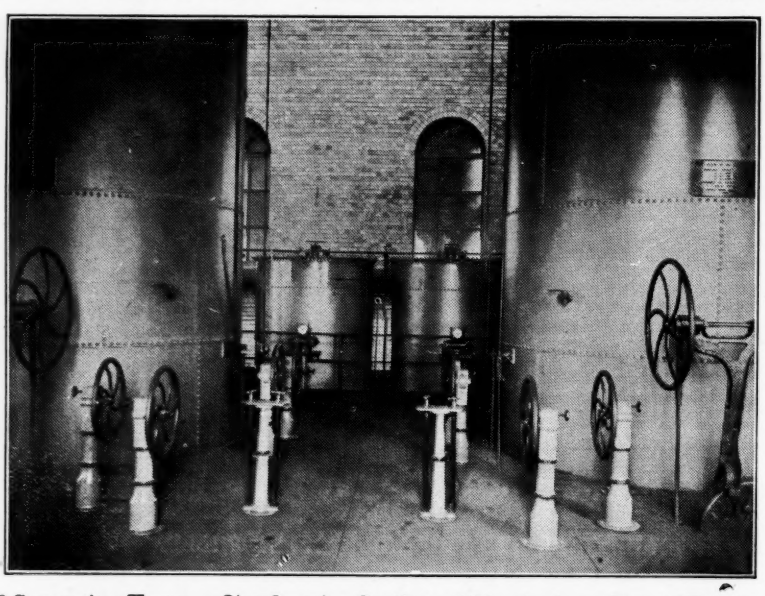

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CURRENT SALES OF GAS PRODUCTS.

LIVERPOOL, *Sept.* 29.

Sulphate of Ammonia.—Although there has been some improvement in the forward position, this has not reflected itself upon prompt delivery; values being barely maintained. The closing quotations are £10 10s. per ton f.o.b. Hull and Leith; and £10s. 13s. 9d. to £10 15s. per ton, delivered f.o.b. Liverpool. Sales, are, however, reported abroad at a substantial discount upon the equivalents of spot quotations—presumably forced sales of parcels held by speculators. There has been more buying going on, though buyers continue the delaying of their purchases as far as possible; but production is now increasing, and supplies are becoming more abundant. The circumstances prejudicially affecting the Scotch market are not yet removed; and Scotland remains the weakest point. £10 13s. 9d. per ton, Beckton terms, having been accepted in London for October-March delivery, the quotation was advanced to £11 per ton; but buyers have refused to follow. For delivery up to the end of the year, £10 15s. per ton is quoted. For delivery f.o.b. Leith, ordinary terms, makers ask variously £10 17s. 6d. to £11 per ton; but there are speculative sellers at £10 15s. per ton.

Nitrate of Soda remains quiet; and, owing to arrivals, the quotations have been reduced to 8s. 3d. per cwt. for fine, and 8s. 1½d. for ordinary, quality.

LONDON, *Sept.* 29.

Tar Products.—This market is a little steadier; but the fluctuations that have taken place in it during the past three months have rather confused makers, who find it difficult to make up their minds as to the immediate future of the trade. Undoubtedly those who have paid a high price for tar are now smarting for their former sanguine views. A good business is being done in benzol; and large quantities are now being diverted from colour-making. Aniline makers are becoming a little alarmed at this, and are desirous of covering, with raw material, forward sales. Carbolic acid is in good request at a little better price. The value of crude has at last forced an improvement in the price quoted for crystals, which for some time have been out of parity. As much as 1s. per lb. is obtainable for a good make of crystals. Pitch is only moderately held. But most makers are committed for early shipments; and there is very little business of late noted. There is no improvement in oils; and anthracene is still a dead letter.

Values during the week may be taken as: Tar, 15s. to 23s. Pitch, east coast, 36s. to 37s. 6d.; west coast, 33s. Benzols, 90's, 10½d.; 50's, 1s. Toluol, 1s. 2½d. Solvent naphtha, 1s. 3d.; crude naphtha, 4d.; heavy naphtha, 1s. Creosote, 1¾d. Heavy oils, 3d. Carbolic acid, 60's, 3s. Naphthalene, 65s. to 75s.; salts, 40s. to 50s. Anthracene, nominal, "A," 4d.; "B," 2½d.

Sulphate of Ammonia is flat; and buyers are holding off to see if the market is likely to go lower. Makers are not lending themselves to the "bear" operations that are going on, as very little sulphate is being held. £10 10s. per ton, less 3½ per cent., however, may be taken as the average value at all ports.

COAL TRADE REPORTS.

From Our Own Correspondents.

Lancashire Coal Trade.—As intimated last week, there has been no further upward move in prices with the 1st of October; but generally the position, as regards all descriptions of round coal, continues exceedingly strong. As collieries are still able to get better prices on coal for shipment than on inland sales, they are quite indifferent about any present slackening off in home requirements, as all the surplus they have can be readily disposed of for delivery at Lancashire ports. In house-fire qualities the demand has moderated to something like its normal condition. Here and there collieries are enabled to put small quantities of the best qualities of round coal into stock, but in nothing like sufficient amount to meet any extra winter requirements. Common round coals are in fairly good inland request, for steam and forge purposes; but were it not for the pressure of shipping demands, these would probably be rather plentiful on the market. As it is, best coals are exceedingly strong at 16s. 6d. to 17s. 6d. per ton at the pit, seconds 15s. to 15s. 6d., common house coal 14s. to 14s. 6d., with steam and forge coals not quoted under 12s. 6d. to 13s. on inland sales. The shipping demand, as already stated, is exceedingly brisk; and from 17s. to 18s. is being readily obtained for ordinary steam coal delivered at the ports on the Mersey. Engine fuel continues to hang on the market, owing largely to the unsatisfactory situation of the cotton trade; and although Lancashire collieries do not reduce list rates, the tendency is in a weakening direction, as there are plentiful surplus lots offering on the market at much below local quotations, and merchants and large consumers are generally content to keep themselves supplied from hand-to-mouth, mainly with cheap special lots they are able to pick up. The quoted list prices at Lancashire collieries remain on the basis of about 10s. 6d. per ton for the best descriptions of slack, with lower qualities of fine screened slack obtainable in some cases at about 8s. 6d. to 9s., as these are really the classes of fuel just now most plentiful on the market.

Northern Coal Trade.—Business has been more irregular in the last few days; there being a lessened demand for some kinds of coals, and an increased inquiry for other qualities. For best Northumbrian steam coals, the demand now shows the falling off that is usual when the end of the Baltic shipping season is approaching, and whence the range of prices shows a little ease—about 18s. to 18s. 6d. per ton f.o.b. being now the current quotation. Second qualities are about 17s. 9d. per ton; and steam smalls may be had at about 11s. 3d. In the gas coal trade, it is believed that further contracts have been entered into for supplies during the coming winter for Metropolitan use, and that the prices are very near to 16s. per ton f.o.b. For occasional cargoes, as high as 18s. 6d. per ton f.o.b. is asked; but there is only a limited amount for sale, and beyond the contracts entered into gas coals may be said to be scarce. There is little change in other kinds of coal. In coke, the market is weaker; and there is a rather lower price for export qualities, though for blast-furnace coke the demand is very full. Prices are on the basis of 31s. to 33s. per ton f.o.b. for export, and about 27s. 6d. at the blast-furnaces. Gas coke is steady, at 24s. to about 25s. 6d. f.o.b.; these prices being quoted on

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Change, and recent business having been at medium rates, though gas coke is being delivered at lower prices on contract.

Scotch Coal Trade.—There is an easier tone in the market. The export trade shows a disposition to slacken, which may be only temporary; but if it should continue, rates will soon come down. The prices are: Main 15s. to 15s. 3d. per ton f.o.b. Glasgow, ell 16s. 6d. to 17s. 6d., and splint 16s. 6d. to 17s. The shipments for the week amounted to 255,272 tons—a decrease of 10,306 tons upon the previous week, but an increase of 85,906 tons upon the corresponding week of last year. For the year to date, the total coal shipments have been 8,030,476 tons—which represents an increase of 1,472,909 tons upon the corresponding period of last year.

The Transfer of the Spalding Water-Works to the District Council.—The annual meeting of the Spalding Water Company took place last Friday—Alderman W. H. Mills, J.P., presiding. The report and accounts were adopted, and a dividend of 6 per cent. declared; a sum of £142 being carried forward. Reference was made to the transfer of the undertaking. In April last, the Directors entered into a provisional contract for the sale of the works to the Urban District Council; and an Act was passed last session authorizing its completion. This was the final meeting of the Company, as the works, &c., will be forthwith transferred to their new owners.

Dorking Water-Works Purchase Question.—With the view of simplifying the legal procedure necessary to acquire the Dorking Water Company's undertaking, a proposal has been made (but not yet finally adopted) that the District Council should solely promote a Bill in the forthcoming session of Parliament for the acquisition of the concern, under the powers conferred by section 26 of the Dorking Water Act, 1900, and that they should enter into an agreement with the Rural District Council (if required by the latter to do so within a stipulated period) to transfer the whole undertaking to a Joint Board consisting of members of both Councils as soon as the same could be constituted by the Local Government Board.

Torquay Gas Company.—Presiding at the half-yearly meeting of the Torquay Gas Company on Friday, Mr. J. Kitson said the receipts for the six months ending June 30 amounted to £15,170, and the disposable balance was £3842. Of this, £3396 was required for the dividend, which would leave £446 to be carried forward, as compared with £575 last year. Considering the state of the labour and coal markets, he thought the result of the half-year's working very satisfactory. The Directors' report and the accounts were adopted, and the usual dividends declared. The Engineer to the Company (Mr. R. Beynon) made a brief statement respecting the recent conference of Gas Engineers in Paris, and especially referred to the fact that the use of electricity for street lighting is being discontinued in Continental towns. He said that in Paris incandescent gas-burners were being substituted for electricity; but the lamps were placed much closer together than in Torquay, and the lighting was better than that of the electric arcs.

Transfer of the Blaenavon Water-Works.—It was announced at the meeting of the Blaenavon District Council last Wednesday that the water-works of the local Gas and Water Company would be handed over to the Council on the 29th (last Saturday). The amount of the purchase money and costs was £10,801 4s. 6d.

The Water Finances of the Swansea Corporation.—The Borough Accountant of Swansea (Mr. H. H. Hopton) has lately issued the abstract of accounts of the Corporation for the year ended March 31 last. With regard to the water-works, the income from all sources during the year was £21,035; and the gross expenditure, including £21,830 for interest and sinking fund, was £29,511. The loss upon the undertaking chargeable to the general district rate was therefore £8476, against £10,000 for the previous year. The Water Department has this year, for the first time, been credited with water used for flushing sewers, watering streets, &c., amounting to £1289.

Exmouth Gas Company.—The report presented at the half-yearly meeting of the Exmouth Gas Company last Thursday showed that the receipts amounted to £3574, and the expenditure to £2949; leaving a profit of £625. The make of gas had increased by 9·6 per cent., and the consumption had been well maintained; showing that the efforts to popularize gas through the use of cooking-stoves and fires and the automatic meter system had met with a large amount of success. The adoption of the report was moved by the Chairman (Mr. J. Palmer). Mr. H. A. Willey, speaking in support of the motion, said the extra cost of coal was equal to 10d. per 1000 cubic feet of gas; but the Company had only raised their price 6d. The difference would, they hoped, be made up by increased consumption of gas. The report was adopted, the usual dividends were declared, and the meeting endorsed a proposal that the salary of the Manager (Mr. J. T. Foster) should be increased by £30 per annum.

The Norwich Corporation and the Gas Company's Accounts.—It may be remembered that a few months ago an action was brought by the Norwich Corporation against the British Gaslight Company, Limited, on terms of a reference to Messrs. Cash, Stone, and Co., who had been selected by the Law and Parliamentary Committee to take an account of the amount employed by the Company as working capital at their Norwich station on the 31st of December last. At the meeting of the Corporation last Tuesday, the Committee reported that they had arranged a settlement of the action, the Company paying all costs as between solicitor and client and the Accountants' charges. Mr. Hackblock, in presenting the Committee's report, said the question was merely one of rectification of the accounts. In reply to a question, the Town Clerk (Mr. G. B. Kennett) said the Corporation thought the Company were charging interest on money upon which they ought not to have charged. But further investigation showed that the Corporation Auditor had known the fact for a long time, and the Corporation were bound by his knowledge; so that it was impossible to get any of the money back. Mr. G. Watson remarked that this question came up some time back, when he was on the Gas Committee; and it was felt that the gas accounts were not fairly and properly investigated. The report was adopted.

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The Question of Gas Profits and the Rates at Manchester.—Alderman Gibson has given notice of his intention to move the following resolution at the meeting of the Manchester City Council to-morrow: "That, in the opinion of this Council, the present system of subsidizing the rates out of the profits of the gas undertaking is wrong in principle, unjust in practice, inimical to the best interests of the ratepayers, and ought to be discontinued."

Contemplated Gas-Works Extensions at Bradford.—The main subject dealt with at last Friday's meeting of the Gas Committee of the Bradford City Council was the question of enlarging the gas-works. A resolution was adopted recommending the Council to seek powers in connection with the proposed Bill to be promoted in the next session of Parliament for extending the Birkshall and Valley Road works. The intention is to utilize lands belonging to the Corporation, but on which they are not at present authorized to manufacture and store gas; and it will be necessary to apply for power to borrow £150,000, in order to carry out the scheme.

High Wycombe Gas Company.—At the recent half-yearly general meeting of this Company, the Directors reported that the business continued to expand very rapidly, and that the profit on the working in the six months ending June 30 justified them in recommending dividends of 6 per cent. for the half year on the ordinary shares (making 12 per cent. for the year) and of 4½ per cent. for the half year on the additional shares (making 9 per cent. for the year), free of income-tax. They said it was very gratifying to them to be able to state that the consumption for the year ending June last, as compared with the preceding twelve months, showed an increase of nearly 15 per cent. This was in consequence of the innovations adopted by them in supplying gas-engines on the hire-purchase system, and the fixing of fittings for manufacturing purposes free of cost, coupled with the extraordinary demand for lights and cookers, principally supplied on the slot system, which was greatly appreciated. During the year, the number of gas cookers, grillers, and fires had increased by 429; the number now out being 1013. The number of slot meters was 896—an addition of 251; and orders were being daily received. The Chairman (Mr. George Wheeler), in moving the adoption of the report, referred to the increase in the Company's business, which he attributed in a large measure to the assiduity of the Engineer and Secretary (Mr. J. F. Wicks), who had, he said, been most attentive in looking out for new houses and workshops in which gas might be introduced. The exhibition of gas appliances which they had held early in the year resulted in a great many orders coming in for cookers and grillers, and had led to greater consumption of gas. Owing to the increase in the cost of coal, the price of gas had been raised in many places; but at High Wycombe, considering all the circumstances, they did not think it was wise to do so, and the figure remained unchanged. Mr. Raffety seconded the motion, and it was carried. The thanks of the meeting were accorded to the Chairman and the Engineer, who each responded. Under the supervision of the latter, the works are in excellent order, and are capable of producing 450,000 to nearly 500,000 cubic feet per 24 hours. Additional exhausting plant has lately been put in.

Gas v. Oil for Village Lighting.—The Nottingham Corporation have recently extended their gas-mains to the village of Burton Joyce; and a number of the residents have availed themselves of the supply thus brought to their doors—the new illuminant being used for the first time on the 21st ult. It is expected that the oil-lamps hitherto in use at the Wesleyan Chapel will be superseded by gas next Sunday. There does not appear, however, to be any anxiety on the part of the Local Authority to adopt gas for the streets.

Leamington Priors Gas Company.—The half-yearly meeting of this Company was held at the offices last Tuesday—Mr. E. Wright presiding. The Directors' report, recommending dividends of 10 per cent. on the "A" and 7 per cent. on the "B" shares, less income-tax, was adopted. The question of the proposed withdrawal of the Corporation from the scheme for purchasing the gas-works was discussed in private, and a resolution was passed, the nature of which was not communicated to the representatives of the Press.

Dorking Gas Company.—The past half-year's working of this Company resulted in a balance of £2483 available for dividend, after providing for interest on the debenture stock. At the meeting of the shareholders last Tuesday, the Directors recommended the payment of the maximum dividends, which would absorb £1069. Ten per cent. increase in the consumption of gas by private consumers was recorded. Compared with the corresponding period of last year, the price of coal had, it was stated, risen from 16s. to 25s. 8d. per ton, causing an increase in the cost of manufacture of at least 10d. per 1000 cubic feet. Notwithstanding this, the Directors had only resolved to increase the price by 6d. The report was adopted.

Gas Politics in the Pulpit.—The "American Gaslight Journal" records the circumstance that Dr. James M. Gray, of Boston (Mass.), while sojourning in Chicago was invited by the Directors of the Chicago Avenue Church to address their congregation. He accepted the invitation, and the harangue was delivered at the morning service on Sunday, the 9th ult. Its title was "The Relation of the Christian Church to Civil Government," and some portions were devoted to the sale of gas. In this relation a part of his speech was as follows: "The people of Glasgow get 1000 feet of gas for 50 cents. How do they do it? The gas plant is owned by the Municipality, and operated on public account. The Board of Aldermen in control contains no boodlers. It would be of little use to turn our gas plants, our street railways, our telephone lines over to such Boards as we now have. Who is it that keeps honest men on the Board at Glasgow? It is the Christian Church." Commenting upon these remarks, our contemporary says: "Why the Christian Church should have anything to do with politics, either in Glasgow or Chicago, is beyond us. But if Dr. Gray wishes to reform gas practice anywhere by injecting into it the spirit of religion, we would suggest that about as fit a centre to begin the good work in as any might be his own home-spot—Boston. Mature consideration, though, seems to indicate that Dr. Gray and all others of his class and calling would better honour their profession by sticking to religion—leaving the gas men, as business men, to work out their own salvation."

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Damage to the Galveston (Texas) Gas-Works by the Hurricane.—We learn from the "American Gaslight Journal" that the Galveston Gas Company fortunately did not lose any of their men by the recent hurricane; but the works have been badly wrecked—the retort-houses and four holders having been demolished.

Determined Suicide in Inverness.—The Inverness Burgh Police have been investigating a determined case of suicide, which took place in an hotel in the town on Sunday, the 23rd ult. A gentleman arrived by train from the South late on the previous night, and engaged a bedroom. On Sunday afternoon it was found that the door was locked from the inside. Entrance having been effected by a window, the man was found quite dead—a long india-rubber tube being suspended from the gas-bracket, and placed under the bed-clothes, which completely covered him. A letter stated that the reason of the act was a domestic disagreement, and giving directions as to how his effects should be disposed of. He was about 25 years of age, and signed his name as John Grant, Ohio.

Local Authorities as Colliery Owners.—We learn from the "Manchester Evening Mail" that the Gas Committee of the Corporation last Friday passed a resolution appointing a Sub-Committee to consider and report as to the desirability of recommending the Council to purchase a coal mine. It may be remembered that notice of a motion to this effect was given a month ago (*ante*, p. 599); and the Committee's decision was, it appears, arrived at without any verbal expression of opinion for or against the proposal, and without the suggestion of any particular mine or any particular locality in which such mine should be situated. This course was adopted by mutual consent, with the object of having all the negotiations carried out as quietly as possible. As will be seen by our "Notes from Scotland," the subject of the municipal ownership of coal mines came before the Glasgow Corporation last Thursday; and it was remitted to the Gas Committee for consideration and report.

Padiham New Gas-Works Scheme.—The Padiham District Council are proposing to make application to the Local Government Board for a Provisional Order and borrowing powers to the extent of £26,000 for new gas-works. But Mr. Monk, at the last meeting of the Council, made an effort to delay the matter. In the first place, he pointed out that work had already been done in connection with the plant, to the amount of £2000; and it was foolish and premature to ask for borrowing powers for £26,000 for new works when they were borrowing £2000 for old ones. This first attack did not prove successful; and later on Mr. Monk moved that the application for a Provisional Order be deferred, and reconsidered in June, 1901. He said the present was an inopportune time to erect the new works. They had spent £1400 during the summer on the present plant, and had greatly increased the supply of gas. If they constructed new works they would also want increased storage room. Besides which electricity was now becoming a serious competitor with gas. In seconding, Mr. Jackson expressed the opinion that, if they needed more gas, they could get it from Burnley. The Chairman (Dr. Joynson) moved an amendment that the matter proceed. Mr. Briggs, in supporting the amendment, gave a history of the scheme since it was begun in 1886. Since 1888 the ratepayers had paid over £2800 for the ground-rent of the land they then secured for the new works. The Chairman remarked that the Council had always been badly treated by Burnley. Other members having spoken, the amendment was carried by eight votes to three.

The Threatened Invasion of American Coal.—Discussing this subject in a leading article yesterday, the "Financial News" said: According to the opinions to be collected in a gathering of experts, the chief obstacle to anything like a regular shipment of Pennsylvanian, Virginian, or any other American coal to Europe, is the barrier Nature has placed in the way. Again, it comes to a question of economics; and in this instance £ *s. d.* spells ocean freights. Let us assume that Mr. Livesey's 4000 tons were put on board at Philadelphia at 12s. per ton, as against 16s. 6d. for Durham or Newcastle gas coal. The ocean freight at the inception of what we may call "Mr. Livesey's experiment" was, even under the special arrangement, 4s. or 4s. 6d. There ought to be a vast superiority in the West Maryland Company's coal to account for the action of such an ordinarily level-headed man as Mr. Livesey in paying 6d. per ton extra, or even the same price, in order to prove to the Durham gas-coal owners that "he could an' if he would" be independent of them. But the representative of the South Metropolitan Gas Company deals only with one special brand, of which, as he says, the tests are incomplete. Take the ordinary bituminous coal, to which New Yorkers are to-day resorting because their anthracite supply—for their stoves—is either cut off or run up to famine prices. We have it on authority that this—the bituminous—cannot be laid down at a United States seaport at less than 10s. per ton. From another authority we learn that "no vessel will carry coal across the Atlantic under 12s. 6d. or 16s. per ton when it can get those rates for cleaner cargoes." The "cleaner cargoes" mean a great deal in the mercantile marine. British owners can afford to send steamships in ballast for cotton, food stuffs, and even to the Gulf States for fruit as well as cotton. Until the States has equipped herself with a fleet of coal cargo boats, she cannot hope profitably to ship coal to Europe. From the last indications, it would appear that there are more remunerative methods of employing £5,000,000 of capital than in building boats to carry American coal north of the Mediterranean line.

The Yeovil Corporation have placed an order with Messrs. Biggs, Wall, and Co., for the supply of one of their "Rapid" charging-machines for erection at the gas-works of the Corporation.

The gas baking-oven made by Messrs. R. & A. Main, Limited, for the Paris Exhibition, and shown in operation in a working bakery there, has been awarded the gold medal, and received the special commendation of the Jury.

The Lymington Gas and Coke Company, Limited, has been registered with a capital of £10,000, in 160 shares of £25 and 960 shares of £6 5*s*., to take over the business of the Lymington Gas and Coke Company, which was constituted by deed of co-partnership dated May 16, 1832.

Mr. Forbes Waddell was, on the evening of Friday last, entertained to supper by a large number of friends—members of the Golf Club and others—on the eve of his leaving Forfar for his new post at Broughty Ferry. Provost M'Dougall, of Forfar, presided, and proposed the toast of prosperity to Mr. Waddell.

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[For Illustrated Advertisement, see p. 864.]

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SECOND-HAND PHOTOMETERS.

MESSRS. Alex. Wright & Co., Ltd., have several second-hand EVANS & LETHEBY PHOTOMETERS, complete with Instruments in thorough working order and good condition, which they can offer at greatly reduced Prices.

Write ALEX. WRIGHT AND CO., LIMITED, Precision Works, 81, Page Street, WESTMINSTER, S.W.

HIGH-PRICED COAL.

SMALL Gas-Works Authorities should immediately adopt an EXHAUSTER, and thus make probably at least 750 cubic feet of gas more from each ton of Coal carbonized. Several small sets *in stock*, both New and Second-hand.

Address J. FIRTH BLAKELEY AND CO., Thornhill, DEWSBURY.

GASHOLDER, Single-Lift, 14 ft. diameter by 10 feet deep, FOR SALE, constructed of Steel Sheets 16 W.G. and quite new, having three Channel-Iron Standards, with Suspension Gearing.

New LETHEBY PHOTOMETER, "Improved Edinburgh Model," by Sugg & Co. Specially designed for use in small Office. Dimensions, 7 ft. 3 in. by 5 ft. 6 in. by 1 ft. 10 in.

For Prices apply to JAS. WRIGHT, Gas Engineer, Bridge House, Blackfriars Bridge, LONDON, E.C.

EXCELLENT SET OF PURIFIERS FOR SALE.

THE Yeadon and Guiseley Gas Company have FOR SALE a set of Four PURIFIERS, 14 feet square, complete with Centre-Valve, Connections, and Travelling Lift. Also a separate CATCH PURIFIER of same size, with Slide-Valves and Travelling Lift.

The whole are now in use in excellent condition, bu must be removed in about a month.

Offers will be received, and further information given, by the Manager, Mr. E. Lister.

Gas-Works, Yeadon,
Aug. 28, 1900.

CITY OF LEEDS.
(GAS DEPARTMENT.)

THE Gas Committee of the Leeds City Council have FOR SALE a TWO-LIFT GAS-HOLDER of about 92,000 cubic feet capacity.

The Holder can be seen, and further Particulars obtained, on application to the undersigned.

Offers for the whole as it stands to be addressed to the Chairman of the Gas Committee, Municipal Buildings, Leeds, not later than Saturday, the 6th of October.

R. H. TOWNSLEY,
General Manager.

Gas Offices, Municipal Buildings,
Leeds, Sept. 22, 1900.

EDINBURGH AND LEITH CORPORATIONS' GAS COMMISSIONERS.

GRANTON WORKS.

THE Commissioners are prepared to receive TENDERS for the construction of CARBONIZING PLANT upon the INCLINED RETORT PRINCIPLE, to the Design and Specification prepared by their Engineer.

Specification and Schedule of Quantities may be obtained upon a payment of Ten Guineas to Mr. W. R. Herring, Chief Engineer and Manager, New Street, Edinburgh; and detailed Drawings may be inspected at his Office by appointment any time on and after the 15th inst. The Ten Guineas will be returned on receipt of *bonâ-fide* Tenders.

Tenders will only be considered on the forms attached to the Specification and Schedule of Quantities, and must be delivered to the undersigned at or before Ten a.m., on the 8th of October, endorsed "Tender for Carbonizing Plant."

The Commissioners do not bind themselves to accept the lowest or any Offer.

JAMES M'G. JACK,
Clerk.

25, Waterloo Place, Edinburgh,
Sept. 11, 1900.

Now Ready. Price, Cloth Bound, 12*s.* 6*d.; Morocco Gilt,* 18*s.*

GAS COMPANIES'
BOOK-KEEPING.

A PRACTICAL TREATISE ON THE KEEPING OF GAS COMPANIES' ACCOUNTS.

By JOHN HENRY BREARLEY and BENJAMIN TAYLOR, of Longwood.

The most complete Treatise on Gas Companies' Book-Keeping ever published.

This book will be found invaluable to those desirous of obtaining a thorough grasp of Gas Companies' Book-Keeping and Accountancy.

A complete set of Transactions are dealt with; the same being entered into the various Books, and posted into the Ledgers. A Model Balance-Sheet is prepared from the set of transactions and postings.

Forms and subsidiary books are illustrated and described. The linking together of the various books is shown at a glance by means of a Chart.

LONDON: WALTER KING, 11, BOLT COURT, FLEET STREET, E.C.

J. FIRTH BLAKELEY & CO., Thornhill, Dewsbury, have FOR SALE:—
One Set of Three 6-ft. PURIFIERS.
One „ Two 8-ft. „
One „ Four 8-ft. „
One „ Four 16-ft. by 12-ft. PURIFIERS.
Four 5-inch ANNULAR CONDENSERS.
Four 10-inch „ „
Six 16-inch „ „
"Cutler" ¾ million "WATER" CONDENSER.
Wrought-Iron TOWER SCRUBBERS, 3 ft. by 14 ft., 3 ft. 6 in. by 27 ft., and 7 ft. by 32 ft.
Cast-Iron TOWER SCRUBBERS, 3 ft. 6 in., 5 ft., and 6 ft. diameter.
EXHAUSTERS, 2000 to 60,000 Cubic Feet per hour.
"Holmes" & "Clapham" WASHER-SCRUBBERS.
"Livesey" & "Cripps" WASHERS.
4-in., 6-in., 8-in., and 10-in. STATION METERS.
Splendid GASHOLDER, 50 ft. by 20 ft.
RETORT IRONWORK, MODERN HYDRAULICS.
Telegrams: "BLAKELEY, THORNHILL LEES."

COUNTY BOROUGH OF BURY.

THE Gas Committee invite Tenders for the supply and erection of a set of WATER-COOLED CONDENSERS, capable of condensing 2 Million Cubic Feet of Gas in the Twenty-four Hours.

Further Particulars may be had upon application to Mr. H. Simmonds, Engineer and Manager, Gas-Works, Elton, Bury.

Sealed Tenders, endorsed "Condensers," to be delivered to the undersigned, not later than Tuesday, the 16th of October, 1900.

JOHN HASLAM,
Town Clerk.

Corporation Offices,
Bank Street, Bury.

BOROUGH OF ROCHDALE.

PURIFIER-GRIDS.

THE Gas Committee of the above Corporation invite TENDERS for the supply of about 7000 square feet of REDWOOD PURIFIER-GRIDS with hard wood Sides.

Particulars may be obtained on application to Mr. T Banbury Ball, the Manager at the Gas-Works.

Tenders, endorsed "Grids," must be sent in to me not later than Noon, on Wednesday, Oct. 10, 1900.

JAMES LEACH,
Town Clerk.

Town Hall, Rochdale,
Sept. 28, 1900.

NEWTON-IN-MAKERFIELD URBAN DISTRICT COUNCIL.

TO TAR DISTILLERS AND OTHERS.

THE Gas Committee of the above Council invite TENDERS for the surplus TAR which may be produced at their Gas-Works for a period of One Year up to the 31st of August, 1901 (approximate quantity about 400 Tons), delivered in the Contractor's own Tanks, free on rails, at Earlestown Station (L. & N.W. Railway).

Form of Tender may be obtained from the undersigned.

Tenders, endorsed "Tar," addressed to the Chairman of the Gas Committee, Town Hall, Earlestown, Newton-le-Willows, to be delivered at my Office, not later than the 17th inst.

The Committee do not bind themselves to accept the highest or any Tender.

C. COLE,
Clerk to the Council.

Town Hall, Earlestown,
Oct. 1, 1900.

By order of the Directors of the
SOUTHAMPTON GASLIGHT AND COKE COMPANY.

NOTICE OF SALE OF
£4630 FIVE PER CENT. ORDINARY STOCK
IN THE
SOUTHAMPTON GASLIGHT & COKE COMPANY,
IN LOTS OF £100.

BANCE, HUNT, & CO. are favoured with Instructions from the Directors of the Southampton Gaslight and Coke Company to SELL BY AUCTION, at the Company's Offices, Ogle Road, Southamptan, on Friday, Oct. 12, 1900, at 2.30 for 3 p.m. precisely.

Further Particulars and Conditions of Sale may be obtained of the SECRETARY Southampton Gaslight and Coke Company, Ogle Road, or the AUCTIONEERS, 67, Above Bar, SOUTHAMPTON.

TONBRIDGE WATER-WORKS COMPANY, LIMITED.

MESSRS. NEVE & SON have been favoured with Instructions from the Directors to SELL BY AUCTION at the Rose and Crown Hotel, Tonbridge, on Tuesday, Oct. 9, 1900, at Three p.m. precisely,

800 £5 SHARES

in the Tonbridge Water-Works Company, Limited, being the first portion of a new issue authorized by the Tonbridge Water Order, 1900, and ranking for Dividend the same as the existing Additional Shares, upon which 6½ per cent. is now paid, and which may be increased until the maximum of 7 per cent. is reached.

The sound financial position of the Company, with its rapidly increasing income owing to the growth of the town, renders the Shares a thoroughly SAFE and RELIABLE INVESTMENT, and for the convenience of Purchasers the Shares will be submitted in 85 Lots.

Particulars and Conditions of Sale may be obtained at the OFFICES OF THE COMPANY, No. 4, The Terrace, TONBRIDGE; from the AUCTIONEERS' INSTITUTE, 57, CHANCERY LANE, W.C.; and from the AUCTIONEERS at their Offices, 1, Bank Street, TONBRIDGE.

BOROUGH OF KENDAL.
(GAS DEPARTMENT.)

GASHOLDER AND STEEL TANK.

THE Gas, Water, and Electricity Committee of the above Corporation are prepared to receive TENDERS for the construction of a STEEL GASHOLDER TANK, 90 feet diameter by 25 feet deep; also of a TELESCOPIC GASHOLDER, Inlet and Outlet Pipes, and Appurtenances, to be erected at the Gas-Works, Kendal.

Copies of the Specification, Bill of Quantities, and Form of Tender may be obtained, and Plans seen, at the Office of Mr. T. N. Ritson, Assoc.M.Inst.C.E., Engineer and Manager, Gas-Works, Kendal, on payment of Three Guineas, which will be returned on receipt of a *bonâ-fide* Tender.

The Committee reserve the right to modify the above-mentioned Specification and Plans, so as to enable Makers of Patent Cable and Spiral-Guided Gasholders and other persons wishing to avail themselves of Patent or other rights or facilities to tender in accordance with the Contractor's own Designs. Such alternative Designs, with complete Plans and Specifications, to be submitted to the Engineer, and approved by him before the Tenders are made.

Sealed Tenders, endorsed "Tank and Holder, Contract No. 2," to be delivered to the undersigned not later than Twelve o'clock noon on Wednesday, Oct. 31, 1900.

The Committee do not bind themselves to accept the lowest or any Tender.

(Signed) JOHN BOLTON,
Town Clerk.

Kent Street, Kendal,
September, 1900.

SALES BY AUCTION OF GAS AND WATER STOCKS AND SHARES.

MR. ALFRED RICHARDS begs to notify that his AUCTIONS of STOCKS and SHARES in London, Suburban, and Provincial Gas and Water Companies are held PERIODICALLY, at the Mart, Tokenhouse Yard, E.C.

He also undertakes the issuing by AUCTION of GAS and WATER STOCKS and SHARES under Parliamentary Powers.

Terms for issuing such Capital, and also for including Gas and Water Stocks and Shares in these periodical Sales, can be obtained on application at Mr. ALFRED RICHARDS' OFFICES, 18, FINSBURY CIRCUS, E.C.

By order of the Directors of the
ILFORD GAS COMPANY.

£7500 FOUR PER CENT. PERPETUAL DEBENTURE STOCK.

MR. ALFRED RICHARDS will Sell the ABOVE BY AUCTION, at the Mart, E.C., on Tuesday, the 9th of October, at Two o'clock, in Lots.

Particulars of the AUCTIONEER, 18, FINSBURY CIRCUS, E.C.

By order of the Directors of the
SOUTHEND WATER-WORKS COMPANY.

NEW ISSUE OF 500 £10 NEW ORDINARY SHARES.

MR. ALFRED RICHARDS will Sell the ABOVE BY AUCTION, at the Mart, E.C., on Tuesday, the 9th of October, at Two o'clock, in Lots.

Particulars of the AUCTIONEER, 18, FINSBURY CIRCUS, E.C.

SOUTH-WEST SUBURBAN WATER COMPANY.

58 £10 FIVE PER CENT. PREFERENCE SHARES,
AND
117 £10 ORDINARY SHARES.

MR. ALFRED RICHARDS will Sell the ABOVE BY AUCTION, at the Mart, E.C., on Tuesday, the 9th of October, at Two o'clock.

Particulars of the AUCTIONEER, 18, FINSBURY CIRCUS, E.C.

By order of the Directors of the
ALDERSHOT GAS AND WATER COMPANY.

500 £10 "E" SHARES.

250 being Seven per Cent. Ordinary Shares, and 250 Five per Cent. Preference Shares.

MR. ALFRED RICHARDS will Sell the ABOVE BY AUCTION, at the Mart, E.C., on Tuesday, Oct. 23, at Two o'clock, in Lots.

Particulars of the AUCTIONEER, 18, FINSBURY CIRCUS, E.C.

By order of the Directors of the
SOUTHEND GAS COMPANY.

NEW ISSUE OF £5000 NEW ORDINARY STOCK.

MR. ALFRED RICHARDS will Sell the ABOVE BY AUCTION, at the Mart, E.C., on Tuesday, Oct. 23, at Two o'clock, in Lots.

Particulars of the AUCTIONEER, 18, FINSBURY CIRCUS, E.C.

By order of the Directors of the
HARROW AND STANMORE GAS COMPANY.

NEW ISSUE OF 250 £10 "C" SHARES.

MR. ALFRED RICHARDS will Sell the ABOVE BY AUCTION, at the Mart, E.C., on Tuesday, Oct. 23, at Two o'clock, in Lots.

Particulars of the AUCTIONEER, 18, FINSBURY CIRCUS, E.C.

By order of the Directors of the
NEW SWINDON GAS COMPANY.

£3719 NEW ORDINARY FIVE PER CENT. STOCK.

MR. ALFRED RICHARDS will Sell the ABOVE BY AUCTION, at the Mart, E.C., on Tuesday, Oct. 23, at Two o'clock, in Lots.

Particulars of the AUCTIONEER, 18, FINSBURY CIRCUS, E.C.

LEA BRIDGE DISTRICT GAS COMPANY.

ISSUE OF £10,000 FIVE PER CENT. PREFERENCE STOCK, at a Minimum Price of £120 per £100, and £10,000 CONSOLIDATED ORDINARY STOCK, at a Minimum Price of £117 per £100.

THE Directors of the Lea Bridge District Gas Company hereby invite TENDERS for

£10,000 FIVE PER CENT. PREFERENCE STOCK,
AND
£10,000 CONSOLIDATED ORDINARY STOCK,

on which the last Dividend was at the rate of Six per Cent. per annum.

Full Particulars, Conditions, and Forms of Tender may be obtained on application to the SECRETARY, at the Company's Offices, 146, 147, and 148, Dashwood House, New Broad Street, LONDON, E.C.

THOMAS DUXBURY & CO.,
16, DEANSGATE, MANCHESTER.
GAS ENGINEERS' AGENTS AND CONTRACTORS FOR
Meters, Fire-Clay Goods, Oxide of Iron, and all other Gas Apparatus. Retort Carbon purchased.
Inquiries Solicited.
Telegrams: "DARWINIAN, MANCHESTER."
Telephone 1806.

ARMSTRONG'S
PATENT
CANDLE SAFETY LAMPS
Are a great improvement on Oil, giving a good Light, requiring little or no Cleaning, and when once lighted no further attention is necessary. The Candles are made to burn 5, 7, or 9 hours.
48, MANCHESTER STREET, GRAY'S INN ROAD, W.C.

HARDMAN & HOLDEN, LD.
ESTABLISHED 1820.
SULPHURIC ACID.
GUARANTEED absolutely free from Arsenic and of excellent Purity. Specially prepared for Sulphate of Ammonia Manufacturers.
Works: BLACKBURN; Miles Platting and Clayton, MANCHESTER.
Head Office: Miles Platting, MANCHESTER.
Inquiries Solicited.

JAMES OAKES & CO.
ALFRETON IRON-WORKS, DERBYSHIRE,
AND
Wenlock Iron Wharf, 21 & 22, Wharf Road, CITY ROAD, LONDON, N.,
Manufacture and keep in Stock at their Works (also large stock in London)
PIPES and CONNECTIONS, 1½ to 48 inches in diameter, and make and erect to order RETORTS, PURIFIERS and TANKS, with or without planed joints, COLUMNS, GIRDERS, SPECIAL CASTINGS, &c., required by Gas, Water, Railway, Telegraph, Chemical, Colliery, and other Companies.
NOTE.—Makers of HORSLEY'S PATENT SYPHONS. These are cast in one piece, without Chaplets; doing away with Bolts, Nuts and Covers, and rendering Leakage impossible.

BOLDON GAS COALS.

Yield of Gas per Ton. .	10,500	Cubic Feet.
Illuminating Power . .	16·9	Candles.
Coke	66·7	Coke.
Sulphur	0·86	Sulphur.
Ash	2·04	Ash.

As per Analysis by
Mr. JOHN PATTINSON, F.I.C., F.C.S.

For Prices, &c., apply to
W. H. PARKINSON,
THE HARTON COAL CO., LTD.,
NEWCASTLE-ON-TYNE.
Telegraphic Address: "PARKINSON, NEWCASTLE."

COKE-BREAKERS,

PRICES REDUCED.

(THOMAS & SOMERVILLE'S PATENT)

With Elevators and Conveyors worked by Steam or Gas Engine.

GEORGE WALLER & CO.,

165, QUEEN VICTORIA STREET, E.C.;

And at STROUD, GLOUCESTERSHIRE.

THORNLEY GAS COALS

WORKED BY THE

WEARDALE IRON & COAL Co., Ld.

OUT OF THEIR

THORNLEY AND WHEATLEY HILL COLLIERIES.

Analysis made by

Messrs. J. & H. S. PATTINSON.

Yield of Gas per Ton . .	10,500 Cub. Ft.
Illuminating Power . . .	16·9 Candles.
Coke (of good quality) . .	67·5 per Cent.
Sulphur	0·58 ,,
Ash	2·73 ,,

For Price, &c., apply to the

WEARDALE IRON & COAL Co., Ld.

QUAYSIDE, NEWCASTLE-ON-TYNE.

THOMAS TURTON AND SONS, Limited,

SHEAF WORKS, SHEFFIELD,

MANUFACTURERS OF

FILES OF BEST QUALITY

FOR ENGINEERS.

STEEL OF ALL DESCRIPTIONS.

SCREW STOCKS, TAPS AND DIES, SPANNERS, RATCHET BRACES, LIFTING JACKS, ANVILS, VICES, AND ENGINEERS' TOOLS GENERALLY.

London Office:

90, CANNON STREET, E.C.

HOLMSIDE GAS COALS.

Present Daily Produce over 5000 Tons.

Latest Analysis—By CHARLES PHILLIPS, Gas Examiner to Rotherham Corporation

Yield of Gas per Ton . . . 11,205 Cubic Feet.
Illuminating Power 16 7/10 Stand. Sperm Candl.
Coke (of good & pure quality) 13¾ Cwt. per Ton.
Sulphur . . . . . A little over 1 per Cent.
Ash . . . . . Under 1 per Cent.
Tar . . . . . 163 lbs. (Avoir.) per Ton.
Ammoniacal Liquor 103 lbs. (Avoir.) per Ton.

HOLMSIDE GAS COALS are supplied to the largest Gas Companies in England and on the European Continent; London alone consuming about half the produce.

SOUTH MOOR PELTON GAS COALS.

Present Daily Produce available 3000 Tons.

Of equal quality to the "Holmside" Coal, and also very largely used by many Gas Companies at Home and Abroad.

Both descriptions are shipped at Tyne Docks, and Dunston Staiths, River Tyne, also at North and South Docks, Sunderland.

These Coals may be bought through the Principal Merchants in England, or direct from

MR. MARK ARCHER,

HOLMSIDE & SOUTH MOOR OFFICES,

NEWCASTLE-UPON-TYNE.

NITRATE of Thorium and Cerium. Fabrik Chemischer Praeparate von Sthamer, Noack, and Co., Hamburg.

DISPENSE WITH CANNEL COAL
and
INCREASE YOUR ILLUMINATING POWER
by using the
WHESSOE-MUNICH BENZOL CARBURETTER
The Cheapest and Best in the Market.

The Managers of Tynemouth, Middlesbrough, and Darlington Gas-Works are much pleased with it, and would not be without it.

Apply to the Sole Makers:
THE WHESSOE FOUNDRY COMPANY, LIMITED, DARLINGTON.

GAS-FITTINGS.

BURNERS

Welsbach Pattern

per 7/6 Doz.

WRITE FOR CATALOGUE.

WHOLESALE FITTINGS COMPANY

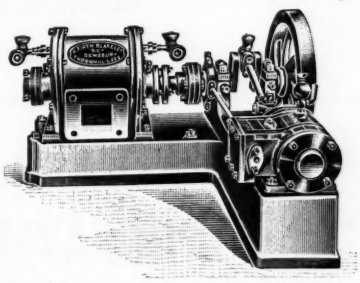
80, Commercial Road, London, E.

INCANDESCENT.

J. Firth Blakeley & Co.,

Gas Engineers,

Thornhill, DEWSBURY.



The **High Prices of Coal** should induce Small Gas-Works Authorities to adopt an Exhauster, and thus effect a large saving in Coal.

Probably at least 750 cubic feet more Gas being made from each Ton of Coal Carbonized.

Several Sets of EXHAUSTING PLANT in Stock, both New and Second-hand.

Particulars sent on application.

Thorough Efficiency Guaranteed.

Exhausters, any capacity.

NEW GAS PLANT OF ALL KINDS. RETORT WORK, CONDENSERS, WASHERS, SCRUBBERS, PURIFIERS, METERS, GOVERNORS, GASHOLDERS, VALVES, &c., IN STOCK OR PROGRESS.

Photos. sent. Inspection invited.

Telegrams: "Blakeley, Thornhill Lees."

LONDONDERRY GAS COALS

FROM THE

LONDONDERRY COLLIERIES,

COUNTY OF DURHAM.

Available Output up to 5000 Tons per day.
Yield of Gas 11,000 cubic feet per Ton of Coal as per Analysis by
Mr. John Pattinson, F.C.S., F.I.S.

For Prices and Particulars, apply to

S. J. DITCHFIELD,

SEAHAM HARBOUR,

COUNTY OF DURHAM.

WELDON MUD

FOR

GAS PURIFICATION.

For use in the

RECOVERY OF SULPHUR,

ALSO

Removal of last Traces of SULPHURETTED HYDROGEN in catch position.

Full Particulars on application to the Patentees:

GAS DESULPHURIZATION CO.,

— LIMITED. —

1, FENCHURCH AVENUE, LONDON, E.C.

Awarded HIGHEST MEDAL and DIPLOMA at the Newcastle-on-Tyne Royal Mining and Industrial Exhibition, 1887, for

CANNEL & COAL.

TYNE BOGHEAD CANNEL.

Yield of Gas per ton	13,155 cub. ft.
Illuminating Power	38·22 candles.
Coke per ton	1,301·83 lbs.

EAST PONTOP GAS COAL.

Yield of Gas per ton	10,500 cub. ft.
Illuminating Power	17·8 candles.
Coke	70 per cent.

SOUTH PELAW MAIN GAS COAL.

Yield of Gas per ton	10,500 cub. ft.
Illuminating Power	16·3 candles.
Coke	73·1 per cent.

For Prices and complete Analysis, apply to

THOS. W. DANCE, SON, & HUNTER,

Coal Owners, Newcastle-on-Tyne;

or

E. FOSTER & CO.,

21, John Street, Adelphi, London, W.C.

UNEQUALLED.

Gas Companies are solicited to try Samples of the

MIRFIELD

BLACK BED GAS COAL.

Prices and Analysis on application.

MIRFIELD (GAS-COAL) COLLIERY COMPY.

RAVENSTHORPE, NEAR DEWSBURY.

NEWBATTLE CANNEL.

Highest Results in Gas, & Excellent Coke.

QUOTATIONS ON APPLICATION TO

THE LOTHIAN COAL COMPANY,

LIMITED,

NEWBATTLE COLLIERIES,

DALKEITH, N.B.

HEATHCOTE GAS COAL.

Rich in Illuminating Power and Yield of Gas.

Above the Average in Weight and Quality of Coke.

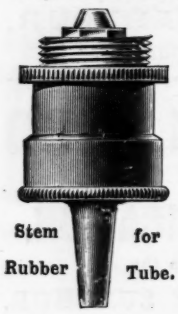
Maintains a High Standard in Residuals.

THE GRASSMOOR CO., LD.

CHESTERFIELD.

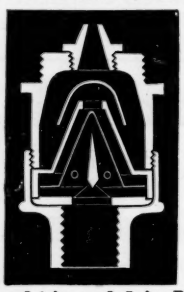
SPECIAL GOVERNOR FOR INCANDESCENT LIGHTING.

Top of GOVERNOR SCREWS Direct into Tube of BURNER, and is tapped to receive Incandescent Company's Nipple.



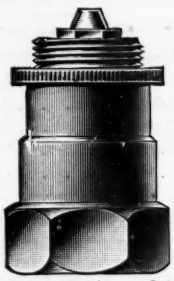
Stem Rubber for Tube.

Requires only $\frac{3}{10}$ths higher pressure than is necessary to pass the Gas through Nipple without a Governor.



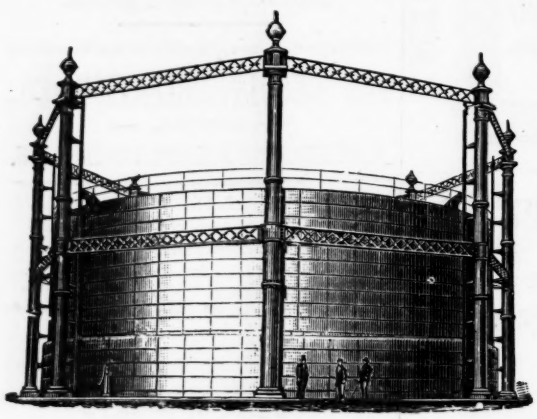
Tapped $\frac{3}{8}$ in. and $\frac{7}{16}$ in. Brass.

Most Satisfactory and RELIABLE GOVERNOR on the Market.



Hexagon Tapped $\frac{3}{8}$ in. and $\frac{1}{2}$ in. Iron.

D. BRUCE PEEBLES & CO., TAY WORKS, EDINBURGH.



PORTER & CO.,

GAS ENGINEERS,

MANUFACTURERS, IRONFOUNDERS, & CONTRACTORS,

GOWTS BRIDGE WORKS,

LINCOLN.

Telegraphic Address: "PORTER LINCOLN." National Telephone, No. 13.

ESTIMATES FOR GAS-WORKS OF ANY SIZE.

References to 600 Works already erected.

N.B.—All Communications to be addressed to the FIRM ONLY.

MILNE'S PATENT

PREPAYMENT DRY METER

Most compact Attachment yet introduced.

Same Height as an Ordinary Meter.

Composite Attachment Cover, easily removable, with extra large Money-Box, which is withdrawn while opening Door.

Absolutely Positive in Action.

The whole Mechanism always in Gear.

JAMES MILNE & SON, LTD.

Milton House Works **EDINBURGH.**

LONDON. GLASGOW. LEEDS.

INCLINED RETORTS.

HORIZONTAL RETORTS.

RETORT BENCHES AND SETTINGS,

WITH

GENERATOR OR REGENERATOR FURNACES.

W. J. JENKINS & CO., Ltd., RETFORD.

THE DELLWIK-FLEISCHER WATER-GAS PROCESS

For Increasing the Capacity of Coal-Gas Works, also for Incandescent Lighting, Driving of Gas-Engines, and Manufacturing Purposes.

(PATENTS IN ALL COUNTRIES)

Plants contracted for within the last Eighteen Months for the following Gas-Works: KÖNIGSBERG, ISERLOHN, LYONS, ERFURT, REMSCHEID, PFORTSHEIM, PLAUEN, BARMEN-RITTERSHAUSEN, NUREMBERG, BRUMMEN,* OSTERFELD,* WARSTEIN,* WIBORG,* WEST BROMWICH.

[* Blue Water Gas with Incandescent Burners.]

ALSO TWENTY-SEVEN INSTALLATIONS FOR MANUFACTURING PURPOSES.

THE DELLWIK-FLEISCHER WATER-GAS SYNDICATE,

25, VICTORIA STREET, WESTMINSTER, LONDON, S.W.

THE SILICA FIRE-BRICK COMPANY,

OUGHTIBRIDGE, NEAR SHEFFIELD,

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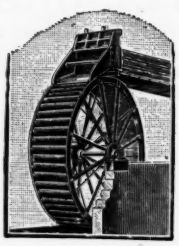

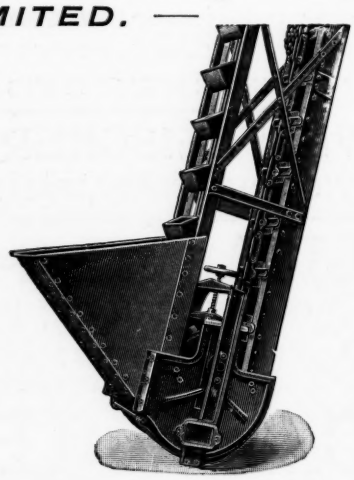

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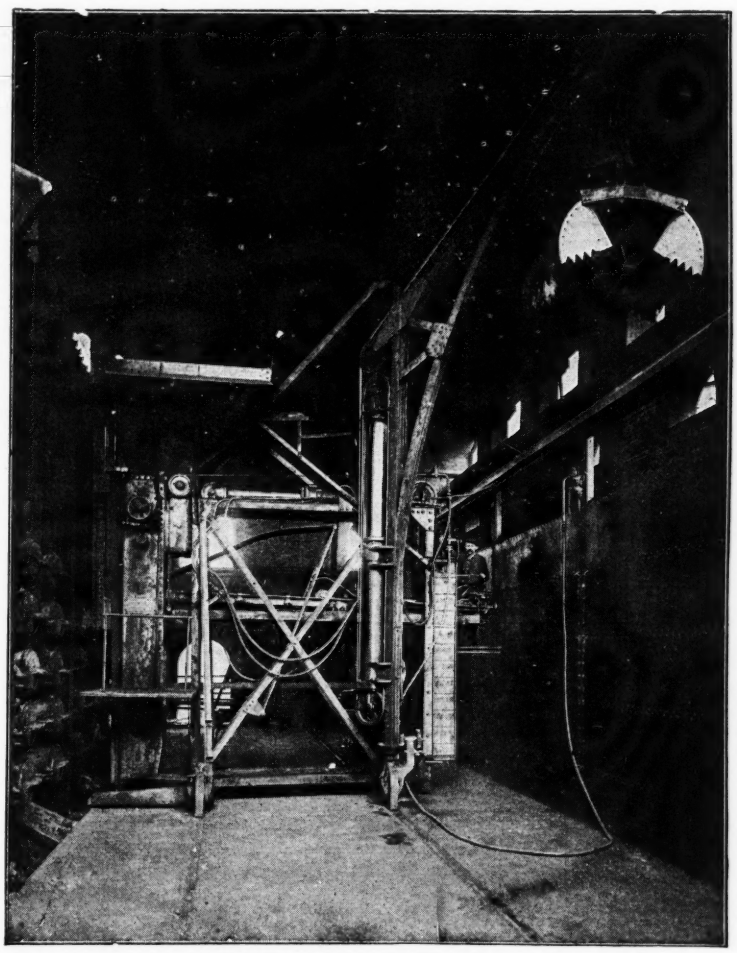

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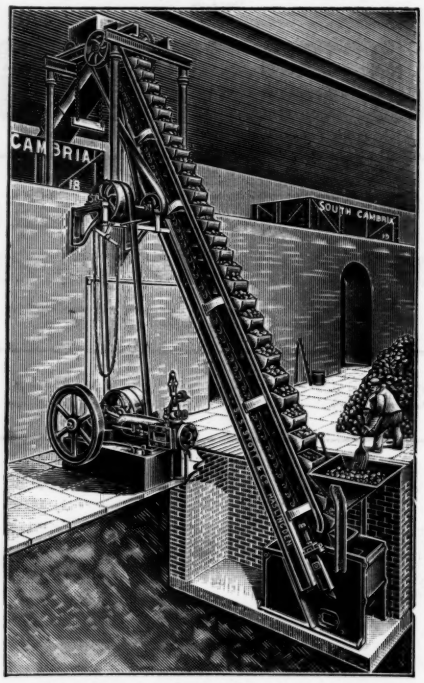

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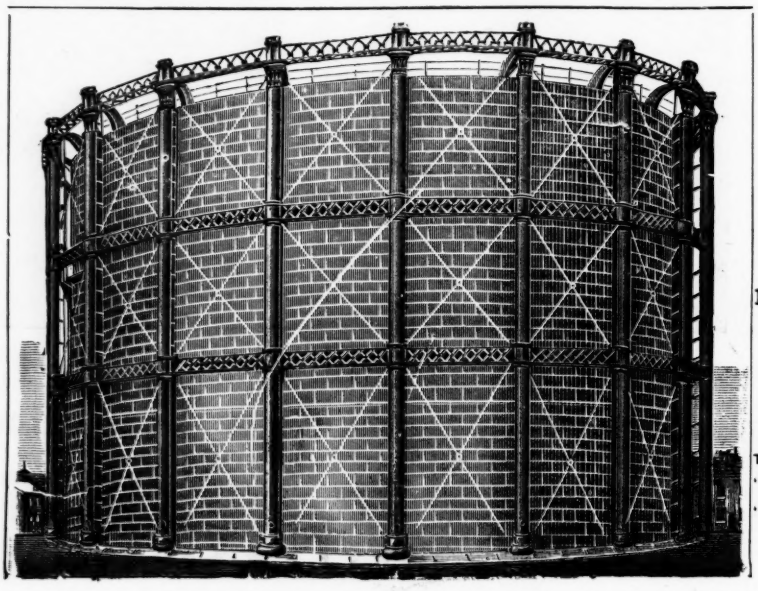

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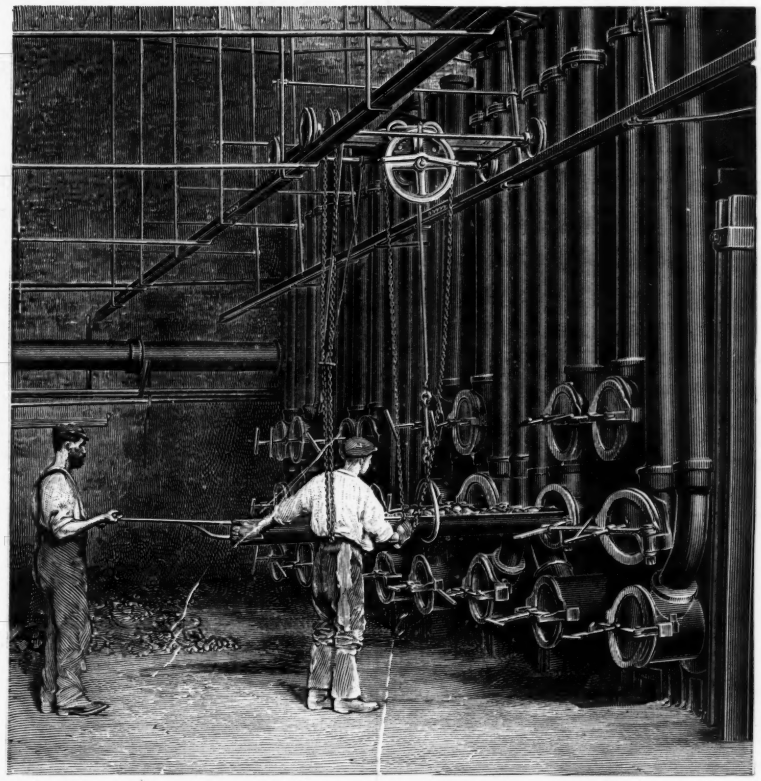

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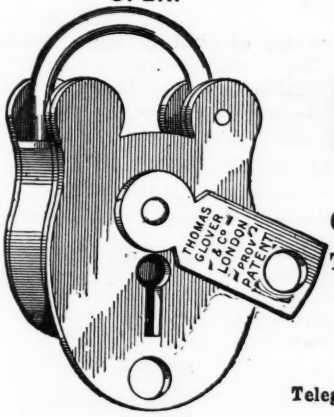

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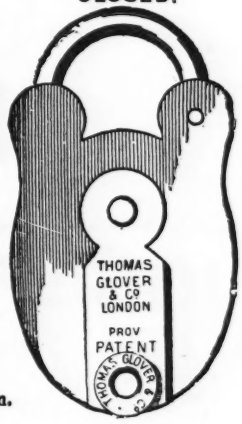

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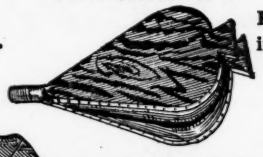
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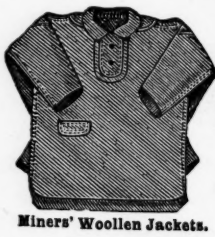
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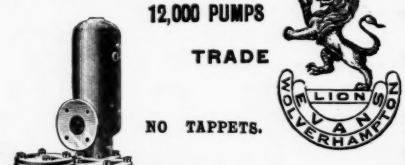

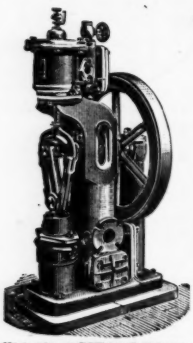
Fig. 705. "SINGLE RAM" STEAM-PUMP.

Fig. 598. "CORNISH" STEAM-PUMP FOR BOILER FEEDING, &c.
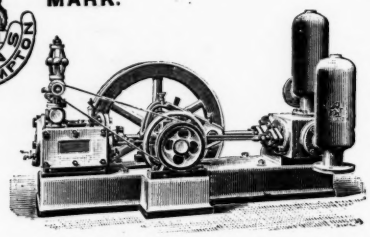
Fig. 685. "RELIABLE" STEAM-PUMP FOR TAR AND THICK FLUIDS.
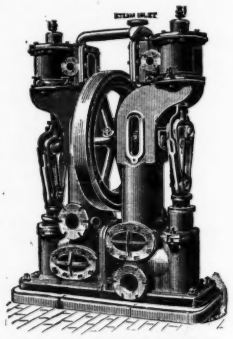
Fig. 712. "DOUBLE-RAM" STEAM-PUMP.

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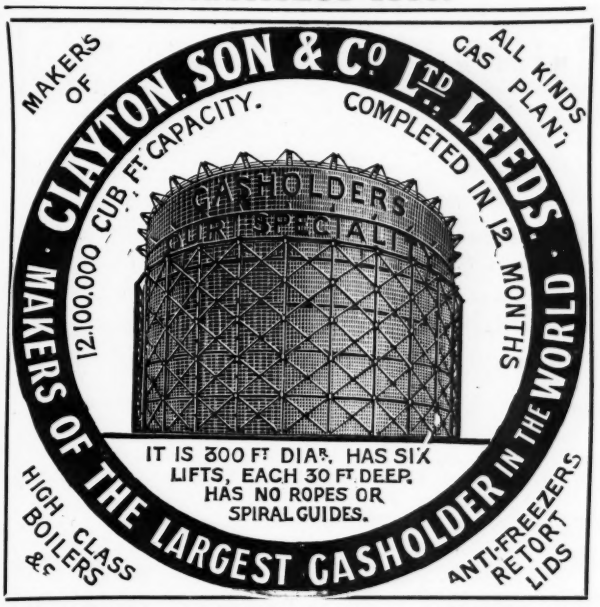
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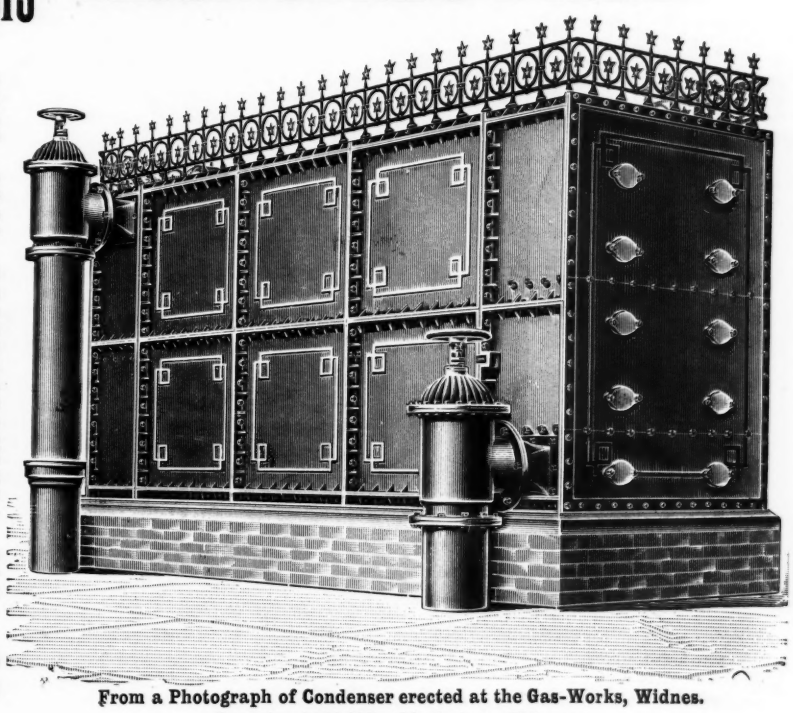

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